THE GAS JOURNAL

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A Glance at the Contents

Distribution from Southend to Windsor—1870-1932.

We publish to-day the fourth instalment of Mr. Escreet's paper dealing with distribution at high and medium pressures in the area of supply of the Gas Light and Coke Company, [p. 783.]

Complete Gasification in Vertical Retorts.

Published to-day is an abstract of a paper on this subject read by Dr. M. Barash and Mr. T. A. Tomlinson before the North-Western Section of the Institute of Fuel, at a meeting in Manchester on March 18. [p. 789.]

Board of Trade Inquiry at Yeovil.

Objections to the sites suggested for the proposed new gas-works and gasholder on the ground that they were unsuitable and would injure the amenities of certain property in the district were offered at a Board of Trade inquiry held at Yeovil on Tuesday of last week, when the application of the Yeovil Town Council for Special Orders under the Gas Undertakings Acts was considered. [p. 798.]

Freedom for the Tenant.

The Kettering Gas Bill, which contains a proposal to prevent the Kettering Council from imposing conditions that only electricity shall be used in the houses and streets in that area constructed out of public funds, was read a second time in the House of Commons last week. We publish a report of the spirited and important debate. [p. 786.]

Free Carbon in Tar.

This question is discussed, from the carbonizer's viewpoint, by a contributor, who suggests the carbonization of wet coal as a means of reducing the free carbon formation. [p. 787.]

Constitution of Coal.

Members of the London and Southern District Junior Gas Association gathered in force on March 18 to hear a lecture on "Coal Constitution and Carbonization" by Dr. R. Lessing, the eminent authority on the subject. [p. 791.]

Imperial Continental Gas Association.

An Extraordinary General Meeting of the Imperial Continental Gas Association was held at Winchester House, Old Broad Street, London, on Tuesday, March 22—Sir Henry Birchenough, Bart., K.C.M.G. (Chairman), presiding. [p. 797.]

British Gas Light Company, Ltd.

The Two Hundred and First Ordinary General Meeting of the British Gas Light Company, Ltd., was held on Wednesday, March 23, at the Chief Office of the Company, 2, The Abbey Garden, Westminster, S.W. 1—Mr. Henry Woodall, M.Inst.C.E., Chairman and Managing Director, presiding. [p. 799.]

Forthcoming Engagements

April 5.—INSTITUTION OF GAS ENGINEERS.—Joint Lighting Committee, 2.15 p.m., 28, Grosvenor Gardens, S.W. 1.

April 7.—MIDLAND JUNIOR ASSOCIATION.—Paper by Mr. W. E. Cone.

April 8.—NORTH BRITISH ASSOCIATION.—Spring Meeting, Edinburgh.

April 9.—LONDON AND SOUTHERN DISTRICT JUNIOR ASSOCIATION.—Visit to Sydenham Works of the South Suburban Gas Company.

April 11.—INSTITUTION OF GAS ENGINEERS.—Finance Sub-Committee, 2 p.m.; Finance Committee, 2.30 p.m.; Executive Committee of the Council, 3 p.m.; Benevolent Fund Committee of Management, 4.30 p.m.; 28, Grosvenor Gardens, S.W. 1.

April 12.—NATIONAL GAS COUNCIL.—Meeting of Central Executive Board, 28, Grosvenor Gardens, S.W. 1.

April 12.—INSTITUTION OF GAS ENGINEERS.—Council, 10 a.m.; Joint Research Committee of the Institution and Leeds University, meeting, luncheon, and visit to Croydon Gas-Works; Education Committee, 4 p.m.; 28, Grosvenor Gardens, S.W. 1.

April 13.—INSTITUTION OF GAS ENGINEERS. — Liquor Effluents and Ammonia Sub-Committee, 10.30 a.m.; General Research Committee, 2.30 p.m.; 28, Grosvenor Gardens, S.W. 1.

April 16.—MIDLAND JUNIOR ASSOCIATION.—Paper by Mr. W. W. Smirles, B.Sc.

April 16.—YORKSHIRE JUNIOR ASSOCIATION.—Meeting at Rotherham and President's Address.

April 23.—WESTERN JUNIOR ASSOCIATION.—Meeting at Trowbridge and President's Address.

May 4 and 5.—EASTERN COUNTIES ASSOCIATION.—Spring Meeting at Great Yarmouth.

May 6.—NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.—Annual Meeting, Newcastle-upon-Tyne.

May 6.—LONDON AND SOUTHERN DISTRICT JUNIOR ASSOCIATION.—Annual Business Meeting.

May 10.—NATIONAL GAS COUNCIL.—Meeting of Central Executive Board, 28, Grosvenor Gardens, S.W. 1.

May 10.—NATIONAL GAS COUNCIL.—Annual General Meeting.

May 11.—YORKSHIRE JUNIOR ASSOCIATION.—Visit to Messrs. G. & T. Earle, Ltd., Wilmington.

May 14.—SCOTTISH JUNIOR ASSOCIATION (EASTERN DISTRICT).—Annual General Meeting in Edinburgh.

May 26.—SOCIETY OF BRITISH GAS INDUSTRIES.—General Meeting in London.

June 7-9.—INSTITUTION OF GAS ENGINEERS.—General Meeting in London.

June 14.—NATIONAL GAS COUNCIL.—Meeting of Central Executive Board, 28, Grosvenor Gardens, S.W. 1.

1932 "JOURNAL" Directory.

Page 32. HINCKLEY. A. B. Britton appointed Engineer and Manager, vice F. Lee, deceased.

Page 62. SOLIHULL. S. J. Sadler appointed General Manager and Secretary.

Page 86. KINROSS. A. Millar appointed Engineer and Manager, vice D. Morton, appointed Engineer and Manager, Arbroath.

EDITORIAL NOTES

Free Carbon in Tar

THE contributor of an article in our columns to-day not unreasonably looks upon a large amount of free carbon in tar as a very great nuisance, due to its deleterious effects on the working of the purification plant and particularly to its action as an emulsifier, which renders difficult the separation of the water from the tar; and he suggests a method of minimizing its formation. Among other investigations on the subject, he calls attention to, and comments on, the work of Hollings, published in the "JOURNAL" for Dec. 1, 1926, which dealt with the influences of free space in the retort, leakage through the retort, size of the retort, and temperature; and then the author puts forward his solution to the problem. The idea is simply to carbonize wet coal. Water added to the coal would prevent the formation of the "cloud of fine dust particles created in the retort when first charging—and which subsequently settles on the top of the coal or is carried up the ascension pipe." It would lessen the violent initial volume of gas; the free space would be cooled; and the time spent by the gaseous products in the heated retort would be shortened, thus reducing decomposition. Moreover, the heat consumption required for evaporating the water need cause no alarm. "As much as 10 p.ct. of water," he states, "does not result in increased fuel consumption."

Though we are not convinced of the accuracy of the last statement—with no extra fuel consumption a 10 p.ct. addition of water appears too high—this question of carbonizing a wet coal in horizontal retorts, intermittent chambers, or coke ovens, is one of great fascination. On the face of it, it seems absurd, but when one regards a retort setting as only one link of the chain of gas-works plant, quite a new light is thrown on the subject. The steam evolved in the early stages of carbonization does assist in the evolution of gas from the coal, and the heat taken up by the steam results in a lower temperature of the crude gas in the hydraulic main. With modern practice the condensing plant is not wholly concerned in condensing steam produced in the retort; it also has to condense the water vapour picked up by the hot gas from the spray of ammoniacal liquor in the main. The amount of this water vapour absorbed is a function of the temperature of the gas—the higher the temperature the more the water vapour taken up. And it is quite conceivable that the lower temperature of the gas, due to carbonizing wet coal, may so affect the absorption that, when the gas from a wet coal reaches the condensers, the water content may be less than that of a gas made from dry coal. In a horizontal installation, water has to be added to the ammonia washer, so that here again carbonization of wet coal cannot be said to affect adversely ammonia recovery. Finally, there is the fact that carbonization of wet coal does not necessarily imply reduced throughput of the installation. All these statements are, of course, subject to the qualification that the amount of water added does not exceed an optimum value; and we confess to some surprise at the high figure quoted by our contributor.

It is to be doubted whether, with so much vertical retort tar on the market to-day, free carbon in horizontal retort tar is such a bugbear as our contributor believes it to be. The specification for Tar No. 3 for the manufacture of tarmacadam laid by the hot or semi-hot process allows a free carbon content within the range of 8-22 p.ct. by weight, while the range for Tar No. 2 is 6-21 p.ct. by weight. In regard to road-making, modern trend of opinion is favouring the use of a more viscous tar than hitherto, and it is likely that in future tars of even higher consistency will be demanded. To-day 50 p.ct. or more of the coal carbonized at gas-works is treated in continuous vertical retorts, and it is doubtful whether it would, on account of its low free carbon content and specific gravity, find a ready sale without the aid of horizontal retort tar containing a relatively high free carbon content and of relatively high density. We are now able to produce a uniform road tar to satisfactory specification from blends of tars which might by themselves be unsuitable. Consistency of tar is the result of many factors, of which free carbon is one.

We do not for a moment suggest that horizontal or even coke oven tars cannot have too high a free carbon content or specific gravity. Indeed, in an extreme case horizontal retort tar produced by high-temperature carbonization of light charges may contain as much as 28 p.ct. of free carbon. Nor do we suggest that excess of free carbon is to be cultivated in the operation of a horizontal retort installation. Our point is that the addition of a large amount of water to coal prior to carbonization is a complicated question. Until we know more about it there are the proved alternatives of controlled liquor spraying, separation of the tar and liquor at the earliest possible moment, storage of tar and liquor separately, carbonization of full charges, and the working of the retorts at level gauge.

Coals for Carbonizing

WHATEVER may be said of the moisture content of coal in relation to its carbonization, there can be no doubt nowadays of the futility of carbonizing coals of high ash content. From the point of view of freightage and handling, which for the moment we are ignoring, both moisture and ash are weighty culprits; but from the moment the coal enters the retort ash is a bugbear, for a variety of reasons well known to our readers, the most potent reason to our mind being the adverse effect on coke sales, and ultimately the profits of the gas undertaking. It is good to see that this point is being emphasized consistently now in almost every review of the Gas Industry's possibilities. Last year the Industry was particularly fortunate in having the results of carbonizing clean coal—really clean coal—presented with such force and clarity on two occasions, one the First International Gas Conference, and the other a meeting of the Southern Association of Gas Engineers and Managers. On both occasions the Lessing coal cleaning process was the starting-point of the accounts, and the London Juniors were fortunate this month in being able to persuade Dr. Lessing to deliver a lecture at one of their meetings. This lecture, which was attended by a large and enthusiastic audience, is reported in to-day's "JOURNAL," together with the discussion to which it gave rise. The author, in view of the full information on his process which has recently been published, refers to it merely in passing, though he epitomizes the results as they affect the Gas Industry; and we hope that his belief, as expressed by the following quotation, will quickly find fulfilment: "I feel convinced that before very long the incessant call for cleaner coke will be met by the Gas Industry, and the employment of coal of the lowest possible ash content will contribute more than any other factor towards capturing the domestic and industrial market for smokeless fuel and thus free the Industry from all anxiety for the disposal of its solid product, while, at the same time, adding to the efficiency of its manufacturing processes."

The method of testing cokes which Mr. Hodsman, of the Leeds University, employs has been dealt with in the "JOURNAL;" and recently he tested coke made from

coal cleaned by the Lessing process. The results, which confirm those obtained at the Fuel Research Station, show that the clean coke gives a higher output of heat, and consequently a higher heating capacity of the appliance, and requires less gas for ignition. The major portion of Dr. Lessing's lecture, however, concerned the constitution of coal—a mixture of substances having a very low ash content, as distinct from coal as sold, which is a mixture of coal and extraneous mineral matter consisting mostly of shale, pyrites, and calcite. He explains the formation of coal as a slow process of carbonization; the difference between coal formation and carbonization as it is understood by the Gas Industry is that the latter substitutes high-temperature treatment for the more subtle agencies employed by Nature. "The time required for the preparation of a smokeless fuel in the gas retort is reduced from millions of years in a few hours; but it must be conceded that we have to improve our methods very considerably before ordinary coke attains the excellence of Nature's final carbonizing residue, anthracite." Dr. Lessing's work on the constitution of coal has greatly benefited our Industry; and perhaps it is because of his long and intimate study, and original conceptions, that his lecture is both brief and compact, and so admirably clear and simple. His lecture is, indeed, a model to "thesis writers," who are apt, in their youthful enthusiasm, to dull the brilliance of their work by clouds of unnecessary detail.

The work of Stopes, of Bone and his associates, and of Wheeler and his collaborators is pencilled by Dr. Lessing, and we regard as of much importance his reference to the "rational analysis" of coal evolved by Francis and Wheeler, at present not quite appreciated at its true worth, but the value of which will not decline as it becomes better and more widely known. Stopes's durain, clarain, vitrain, and fusain are now terms on the lips of any student of carbonization technology; and yet these terms were coined less than fifteen years ago. Dr. Lessing has devoted attention to each of these "botanical" components, and his summary of their influences on the carbonizing process is well worth emphasis. In brief, vitrain and clarain are the principal coke-forming constituents, durain while slightly coking under ordinary conditions must be regarded as a "filler," which, however, gives rigidity and possibly strength to coke, while fusain by itself has no coking power at all. Recent work has, however, shown that fusain in small quantities, when homogeneously mixed with coal may influence the strength of the coke, as was mentioned in the "JOURNAL" for Dec. 31, 1930, in connection with the investigations of C. P. Finn.

Electrification

ELECTRICITY has been enjoying during the past week one of those boosts which from time to time impress so deeply upon the public mind the fact that more current is being used in Great Britain. The report of the Central Electricity Board for the year ended Dec. 31 last records that the decline in consumption of electricity in British industry during 1931 was more than made good by extension of domestic and commercial supplies, with the result that the total production increased by 4·5 p.ct. By December last the total value of contracts placed by the Board for the construction of the grid was £21,848,869—an increase during the year of £3,584,000. Practically the whole of the contracts required for the main transmission system have now been placed. During the year the Commissioners issued consents to the borrowing of £4,700,000 for purposes of the grid, and £2,000,000 for standardization—making the totals £25,200,000 and £7,500,000 respectively, or £32,700,000 in all. Last month, it will be recalled, the Board issued £7,000,000 of Central Electricity 5 p.ct. stock.

In the meantime progress is marked by trifling troubles. A new Congregational Church at Wolverhampton was stated in the Press to be "probably the first all-electric church in the Midlands." This claim brought to light the fact that a Wesleyan Methodist Church at West Bromwich was already similarly lighted and heated, as were also several other churches in different districts. But this was not the whole story, inasmuch as one correspondent followed up his reference to installations by the following: "It would be very interesting if the pioneers who have blazed the electric trail would give us the benefit of their experience, not only as to the efficiency of this method of heating, but as to its cost. I know that, in one of the churches I have mentioned, the actual cost of running proved absolutely ruinous, and the system has been abandoned in favour of a more economical one." This desire to learn something about cost was subsequently to some extent satisfied by another correspondent, who, referring to a particular church which had been named, said: "They wish they had never succumbed to the blandishments of the advocates of electricity for heating purposes. It was asserted that the cost would work out to about 5s. a Sunday; but 30s. is nearer the mark—and then it was with a struggle that the thermometer rose to 50° Fahr. in wintry weather."

Flood-Light Now

A STRONG case for flood-lighting with permanent installations, for intermittent use, was made by Mr. Percy Good (who was associated with Mr. J. E. Ames) in a lecture entitled "Illuminating London," which he delivered recently before the London Society. Flood-lighting has, of course, been more or less a live subject since the large-scale experiment took place last autumn in connection with the International Illumination Congress; but so far the results have not been as extensive as its most enthusiastic friends would desire. Some attractive examples have been illustrated in the pages of the "JOURNAL," as having been operated by gas; while electricity also has had its share in the good work. But a great deal more than this can be done, and we believe, with Mr. Percy Good, should be done.

At a time like the present, when the word "economy" is being so sadly misused, the question of expense cannot fail to be raised. There was, indeed, a little criticism on this score regarding the "brighter London" which we were privileged to behold during the International Illumination Congress; but in all probability even this would have been absent, had it been generally realized that the whole of that experiment was carried out entirely free of charge by the commercial undertakings concerned. And had it been a charge upon the community who would say, after full consideration of the facts, that it was unjustified? This is a period of stress and strain, it is true, but it is at just such a time that the cheerful brightness which flood-lighting is able to dispense must be most beneficial to the public. Therefore let us have it without delay, and in no niggardly measure. There can be no doubt that people appreciated what was done last autumn, and not one class of people only—the police who had the task of regulating the traffic on those memorable evenings could testify to this.

The idea of the lecturer was not that flood-lighting should become as much a part of urban life as is ordinary street lighting, but that installations should be provided so as to be available for use at intervals, as desired. In this way would the maximum tonic effect be secured. The added cheerfulness which would result from such illumination is, however, not its only good quality; flood-lighting is educational, as well as decorative. How many architectural beauties have readers discovered by this means, that had never been noticed by them before, even though they had seen the objects frequently? Mr. Good himself gave an example of this. At the present moment the extraordinary beauty of Bow Church steeple is being revealed by flood-lighting. How many people, he asked, were aware of it before? Judicious flood-lighting would afford endless opportunities to Londoners themselves to study the richness of their own city, while visitors, too, would gain accurate knowledge of its worth.

Flood-lighting, as was shown during the lecture to which we have referred, is an art. The great thing, the audience were told, is to avoid monotony, and what is suitable in one set of circumstances may be quite unsuitable in another. A series of models demonstrated that lighting from the bottom may be highly effective; while horizontal lighting can be ineffective. We are fully

in agreement with the argument that, if the best results are to be obtained, architects must study illumination, and lighting engineers must make themselves familiar with architecture. But while they are doing this, a good start may well be made, based upon the knowledge gained during the experiment of last September.

Inventive brains have designed appliances which admirably adapt gas to the purpose in view, and the same may be said with reference to electricity. Among the lantern slides exhibited by Mr. Good were a number of views of the flood-lighting during the International Illumination Congress—among them being the gas lighting in St. James's Park. In this connection the lecturer remarked that the view from the bridge in the Park was one of the most beautiful that could be seen, and this lighting could be maintained for less than one policeman cost! Now, what is to be done about it?

Complete Gasification

In January of this year we published an extract from a comprehensive contribution to the technique of carbonization in modern continuous vertical retorts by Dr. Barash and Mr. Tomlinson, of West's Gas Improvement Company, Ltd. This contribution was presented by the authors at the Third International Conference on Bituminous Coal held in Pittsburg in November, 1931, and attracted much interest. One of the main points of the paper is that for every increment of water gas dilution there is an optimum throughput of coal. Granted this, steaming under correct conditions represents an astonishingly true chemical reaction in which a high efficiency can be obtained in industrial practice at any stage of the process at which it is desired to stop. In one section of the paper attention was devoted to complete gasification—*i.e.*, steaming to the limit—and the Institute of Fuel (North-Western Section) asked the authors to amplify their treatment of this question, with the result that on March 18 they presented at a meeting of the Institute a paper on "Complete Gasification in Vertical Retorts," an extract from which will be found on later pages of this "Journal."

Costs are all-important; and the authors, calculating on a production of 21,600 therms of gas per day, give a figure of 1·85d. per therm. This includes all working charges, maintenance costs, and interest on capital, the cost of the plant (vertical retorts, coal and coke handling equipment, waste-heat boilers, purification plant, and gasholder storage) being taken as £200,000. The figures set out have the greater significance because they are based on practical work carried out by the Research Department of the firm on a full-scale gas-works in operation at the Albion Iron Works; and though no one is as yet making gas in practice steaming to the extent suggested in the article, the authors put forward the opinion that there is more than one set of circumstances in gas-works practice or in heat production generally where steaming to the limit deserves serious consideration.

CORRESPONDENCE

Developments in Gas Fires

Sir,—In your issue of March 16, Herr Körting has very kindly answered a number of the criticisms of the Askania fire which we made in our letter of Feb. 2. He has, perhaps, taken our remarks rather too seriously. Without criticizing unkindly, we wished to direct attention to features which a British manufacturer could not accept without further information. The particulars which Herr Körting has now published will certainly arouse a great deal of interest, and we shall look forward to an opportunity of examining this unusual appliance.

On one point, however, Herr Körting has given us no answer. We would repeat that the forward inclination of the radiants will affect adversely the distribution of radiant heat from the fire. The most suitable distribution is obtained by inclining the radiants backwards at an angle of 20° to the vertical. The increase of useful radiant heat obtained by using this form of construction is very remarkable. The rapid progress in popularity that the Cannon inclined fire has made in recent years against the vertical fire is evident that this increase in useful heat is appreciated by the public.

In conclusion, we wish to congratulate Herr Körting on his very clear explanation of the difficulties which attend the publication, by a manufacturer, of figures of radiant efficiency. It would be of great benefit to the Gas Industry if an independent authority such as the Research Department of the Gas Light and Coke Company were to publish figures representative of various types of fire. This would constitute a definite step towards that greater co-operation between gas appliance makers and gas undertakings in which, we are convinced, lies the further progress of the Gas Industry.

Yours, &c.,
Research Department,
Cannon Iron Foundries.

Deepfields, Staffs.,
March 24, 1932.

Dry Gas Meter Design

Sir,—During the course of the discussion following a paper by Mr. J. H. Bingham on "Dry Gas Meter Design," as reported in your issue of March 23, some observations by Mr. W. M. Paterson, the substance of which is agreed to by Mr. Bingham, lead me to question the practical tendency of their line of thought.

It is necessary to observe that whatever revised conditions or rules for testing and rating may be proposed in the future, they would have to be of such a character as to be sufficiently acceptable to move the Board of Trade to revise the existing regulations accordingly, for only the statutory particulars are permitted to appear on the meter, and it is by those particulars that a meter is known, purchased, used, and no doubt guaranteed by the maker.

Although the existing regulations provide for the use of gas or air at the discretion of the Inspector, air is the general standard in use, and, as I have previously indicated, is likely to become obligatory when revision of the regulations comes about. Why then his suggestion for a return to undesirable and obsolete methods? No suggestion is made of a variation in registration results; it is merely a question of rating and throughput. In view of the fact that air will give some 70 to 75 p.ct. of the possible throughput with gas, on what grounds does the suggestion arise? It would be interesting to learn exactly what can be achieved by the use of gas that is not possible with air, in connection with the "safe working load," whatever that may mean.

My letter in the "Gas Journal" for Feb. 10 will serve to demonstrate that I agree with a suggestion for revision of the system of rating, but not for a system that makes for two capacities. The present regulations do not permit the use of two capacities, and it is inconceivable that any future revision would reverse the condition, for it would be both unnecessary and unworkable. What could be achieved is for the meter to be rated up to a reasonable performance, and be subject to a further requirement of being capable of a percentage overload capacity without exceeding the limit of tolerance for absorption.

The disparity between gas and air in the case of throughput and absorption is one which it would be well to discount, for it might be that the reduced efficiency registered when air is used could be offset against the different conditions obtaining with a meter when it is verified and when it has been in use for a period.

Yours, &c.,
Wm. Templeton.

Gas Meter Testing Station,
Gower Street, Leeds,
March 26, 1932.

PERSONAL

Mr. KENNETH N. DAVIS has been appointed a Director of the Davis Gas Stove Company, Ltd. He is the son of Mr. Harold N. Davis, the Chairman of the Company, was educated at Marlborough, and took an Honours Degree in Engineering at Cambridge.

The Town Council of Arbroath have appointed Mr. DAVID MORTON, Engineer and Manager to the Kinross and Milnathort Gas Light Company, Ltd., to be Gas Engineer and Manager and Lighting Inspector for the Burgh of Arbroath. The salary is £400 per annum, with free house, coal, and gas.

From a list of 54 applicants Mr. A. MILLAR, of Kelty, has been appointed Manager of their Gas-Works by the Kinross and Milnathort Gas Light Company, Ltd., in succession to Mr. D. Morton, who has been appointed Manager at Arbroath. Mr. Millar, who is Assistant Manager at the Kelty Gas-Works, was for a period with the Glasgow Corporation at the Dalmarnock Gas-Works.

Mr. E. W. MUDDIMAN, B.Sc., F.I.C., who was recently appointed Chief Chemist to the Holmside and South Moor Collieries, Ltd., South Moor, Co. Durham, has now taken charge of the new laboratories which have just been built by the Company. Mr. Muddiman was for nearly four years at the Nechells Gas-Works, Birmingham, as assistant to the late Dr. W. B. Davidson, under whose direction he carried out experimental work on toluole extraction from coal gas and carburetted water gas, and preferential removal of toluole by pre-benzolizing of wash oil. The latter was the basis of the "B" process of the Ministry of Munitions, which was the subject of an award to Dr. Davidson by the Royal Commission on Awards to Inventors. After being for six years on the chemical staff of British Dyes, Ltd., Huddersfield, Mr. Muddiman joined Dr. Davidson at Newcastle-on-Tyne, and since 1922 has been engaged in various investigations in fuel technology, including research in connection with the low-temperature carbonization of coal. The new laboratories of the Holmside group of collieries are equipped with the most recent apparatus for fuel testing and analytical work, and there are also accessory rooms for storage, crushing, and grinding of coal samples, a separate muffle room, and the usual offices. The Company pursue a progressive policy, and at the end of 1931 put into commission two new dry cleaning installations for cleaning both gas coals and coking coals, a Birtley plant, and a Raw plant, each capable of treating 100 tons of coal per hour.

THE NEWS OF THE WEEK

The Brixham Gas and Electricity Company have decided, after the reading of the meters for the current quarter, to reduce the price of gas by ½d. per therm.

Eastern Counties Gas Managers' Association.—The Spring Meeting of the Association will be held on May 4 and 5 next at Great Yarmouth, under the Presidency of Mr. P. D. Walmsley, B.Sc., Managing Director and Engineer to the Great Yarmouth Gas Company.

Creosote Oil manufactured by the Gas Department is to be used in future by the Edinburgh Transport Department for their 'buses. Mr. FitzPayne, the Transport Department Manager, states that the fuel is satisfactory and will result in cheapening running costs while at the same time allowing gas to be sold cheaper. The 'bus of the future, he holds, will be gearless, and will be fuelled by oil produced at gas-works.

An Important Scheme for the installation, at the Tradeston Gas-Works, Glasgow, of plant for the manufacture of carburetted water gas is contemplated. The probable cost of the new plant will be £60,000, and the cost of working the plant is estimated at about £1600 per annum. By this process, it is hoped to produce gas at about 11d. per 1000 c.ft., delivered into holders. If approved, the plant would be capable of producing 5 to 6 million c.ft. of carburetted water gas per day. The plant, when working full, would gasify 13,500 tons of coke per annum, and would, incidentally, reduce the purchase of coal per annum by 50,000 tons.

The Wallasey Corporation Gas Undertaking is expected to show a surplus of £8615 on the year's working, as compared with the estimate of £11,412. Sale of gas to private consumers shows a decrease of £8313 owing to the realized sale being about 57 million c.ft. less than the estimate. Against this unexpected reduction in consumption there had been increases from public and private street lighting £515, residual products £841, and miscellaneous £530. Of the available surplus of £9962 it is proposed to allocate as follows: Reserve fund, £4000; new meters and stoves £5720; public street lamps, £168. For the forthcoming year there is an estimated surplus of £6686. It is anticipated that there will be £6760 available for appropriation which has been provisionally allocated as to £5000 for new meters and stoves, £300 for buildings and plant, and £1400 for public lamps.

Brighter Homes.

The accompanying photograph is of the Sheffield Gas Company's stand at the Brighter Homes Exhibition which was held in the Edmund Road Drill Hall, Sheffield, from March 8 to 19.

The lay-out of the stand this year was made up of four sections—Lighting, Heating, Cooking, and Hot Water—thus demonstrating the versatility of gas in the home. Special cards were attached to the appliances giving complete information as to their particular uses. The lighting fittings were of a most up-to-date type complete with switch controls, and included the latest panel and table standard.

The stand was much admired and proved a popular rendezvous for the general public throughout the Exhibition. It is pleasing to record that many valuable orders for the supplying and fixing of appliances and fittings were secured.

THE NEWS—*continued.*

North British Association.

An excellent programme has been arranged for the Spring Meeting of the North British Association of Gas Managers, which will be held on Friday, April 8, in Edinburgh, under the Presidency of Mr. T. W. Harper, of Ayr. Papers will be read by Mr. Arthur Cuthbert, of Grangemouth, and Mr. James W. Beveridge, of Troon. Following luncheon at the North British Station Hotel, a visit has been arranged to the Granton Works of the Edinburgh Gas Department.

On the preceding Thursday a Golf Competition will take place over the course of the Baberton Golf Club, Juniper Green, Edinburgh, on which occasion the Silver Cup, presented by Mr. J. Winson Scott, will be played for.

Tar for Road Making.

The suggestion that British tar should be used on the roads was made at a meeting of the Ilfracombe Urban District Council on Wednesday, March 23.

Mr. F. W. Birmingham, referring to the estimates for the maintenance of the highways, said he understood that tar was being used by the County Council in South Devon with great success, that it was as good as other preparations, more lasting, and cheaper, and he suggested that it should be employed by the Ilfracombe Council also.

Mr. S. A. Somerville, Chairman of the Highways Committee, said they were informed by the Surveyor that tar was a penny a gallon cheaper than the bituminous preparations in use, but that, taking into consideration the heating and extra labour involved with tar, the latter would be more expensive than bitumen.

The Surveyor (Mr. F. B. Goodman) explained that the preparation they were using was produced in Devon.

It was stated that two drums of tar for trial purposes had been offered and accepted, and the Council considered that the result of this test should be awaited before any further action was taken.

Progressive Policy at Wellington.

The Directors of the Wellington (Salop) Gas Company on March 21 entertained the staff and employees at dinner, when over sixty were present.

Mr. R. J. Milbourne (Vice-Chairman of the Directors) presided, and he was supported by Messrs. Lea, Millington, and Dickin (Directors), and Mr. H. J. Woodfine (Managing Director).

The toast of the "Wellington Gas Company" was submitted by Mr. A. Parker, who for 39 years was Manager of the old Oakengates Gas Company. He complimented the Directors of the Wellington Company on their progressive policy, and the up-to-date character of their works.

Mr. Milbourne and Mr. J. S. Dickin replied, both paying excellent compliments to the work of the staff.

Mr. Milbourne proposed the toast of the "Local Councils and Visitors," and in reply Mr. H. W. Pearce (Chairman of the Wellington Council) referred to the amicable relations existing between the Wellington Council and the Gas Company, and said the town was to be congratulated on the progressive policy of the Directors.

Mr. T. Hayward (Oakengates Urban Council) also replied, and said he quite agreed with Mr. Pearce that the district was well looked after by the Gas Company.

IN CONTINENTAL COUNTRIES - - -

Abstract Translations from the Technical Press of France and Germany.

INFLUENCE OF HYDROCARBONS ON THE LIFE OF DRY METER LEATHERS.

W. Schairer describes in "Das Gas- und Wasserfach," 1932, 75, 185-188 (March 5), the results of an investigation on meter leathers.

The effect of gas on the leather is to replace the leather-dressing oils with heavy hydrocarbons which were shown to be of the aromatic type. Samples of various meter leathers, both old and new, were submitted to a modified tensile strength test. The test strips employed were 0·5 cm. wide and 10 cm. long, and had the thickness of the leather as supplied—namely, 0·6-0·7 mm. Load was applied at the rate of 32·2 grammes per second. In view of the variation of tensile strength in different strips from the same skin, some 10-12 test strips are prepared for each test and the mean value is taken.

New leathers supplied by various firms for use at Stuttgart Gas-Works showed breaking loads of 4·9, 5, 3·6, 5, and 8·9 kilogrammes. One old sample which had been in use since 1905 and had been exposed for six years to tetralin employed as a naphthalene solvent showed a breaking load of 5·4 kilogrammes, while two others, in use since 1926, showed low values differing at the edges and centres, and were able to be torn by hand in some places.

When new leathers were soaked in tetralin and in benzole for four weeks and were then allowed to dry in a current of air, the breaking load was reduced, the reduction being somewhat greater in the case of the experiment with benzole. The difference in the behaviour of these two solvents is ascribed to a greater dehydrating and hardening action on the proteins of the leather on the part of the benzole as compared with the tetralin, and to a better lubricating effect on the part of the tetralin.

As a result of the investigation a specification for meter leathers is proposed to the effect that the breaking load of test strips of the dimensions indicated should not be less than 4·7-4·8 kilogrammes. It was established, also, that, for a given thickness of leather, the life is longer the higher the breaking load.

The presence in leather of certain metallic salts (*e.g.*, iron salts) introduced during tanning may, owing to the occurrence of small quantities of sulphuretted hydrogen, cyanogen, ammonia, carbon dioxide, and oxygen in the gas, lead to a reaction and give rise to chemical or physical changes in the leather. For this reason, leathers which have been treated with salts liable to behave in this way should not be used in meters.

CARBONIZATION OF PRESSURE-CREATING COALS.

W. Hauswald in "Brennstoff-Chemie," 1932, 13, 88-91 (March 1), reviews methods available for the treatment of coals which, on being carbonized, create dangerously high pressures.

Blending with a suitable coking coal is one possibility, but the swelling pressure of the blend is not necessarily a linear function of the swelling pressure of the constituents. In some cases, the swelling pressure of the blend may be higher than that of either of the constituents, whereas in other cases the reverse may be true. Hence the choice of the coal to be added must be based on the results of experiment.

Blending with a non-coking coal, with durain, or with coke breeze may also be practised.

A further means consists in the choice of a suitable speed of carbonization. The swelling pressure may be reduced by the use of narrow ovens and by slow carbonization. Audibert recommends subjecting the coal for a comparatively long time to a temperature between the temperatures of incipient and maximum contraction—namely, between about 370° and 420° C.

Weathering provides another means of reducing the tendency to create high pressure; a more rapid alternative to this being preheating.

Sassenhof (German Patent No. 491312) has proposed to heat alternate oven walls only to such an extent that the heat supplied suffices to drive off the moisture and bring the coal to the plastic state without formation of a plastic zone travelling outwards from those walls.

Koppers (German Patent No. 504810) avoids a thrust on individual walls by arranging the oven schedule so that the individual adjacent ovens are in the same stage of carbonization—*i.e.*, are charged and pushed with as small an interval as possible for the two ovens.

A further means consists in securing a minimum bulk density of the coal charge. Hence stamping, if not altogether avoided, must be arranged so that the coke is 2½-3 in. narrower than the width of the oven. The minimum bulk density of the charge may be secured by adjusting the moisture content to an appropriate figure, and care must be taken to ensure that excessively large charges are not introduced otherwise the leveller bars may compress the coal. Furthermore, the charging system must be such that undue compression of the coal in the lower part of the oven does not occur.

Distribution from Southend to Windsor—1870-1932

An Historic Record of Distribution at High and Medium Pressures in the Area of Supply of the Gas Light and Coke Company*

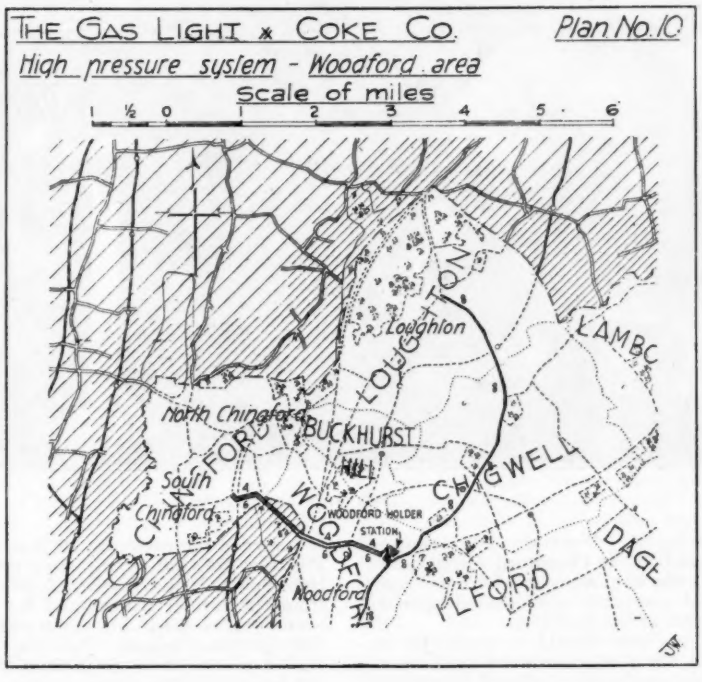
By H. J. Escreet, B.Sc., Assoc.M.Inst.C.E., Assistant Distributing Engineer, The Gas Light and Coke Company.

(*Continued from p. 669.*)

WOODFORD HIGH-PRESSURE SYSTEM.

This system, which is shown on Plan No. 10, was commenced in 1919, and has been subject to frequent modifications since that date. It is proposed to deal with this system in some detail, since it affords an interesting example of the difficulties of applying high-pressure feeder mains to a developing district.

It will be seen from the plan that the system consists of approximately 5 miles of 8-in. main from Woodford Holder Station to Loughton and approximately 2½ miles of 6-in. main, with a 4-in. main in parallel to it, between Woodford and South Chingford. There are no governors at the ends of these mains, but two Widlake distant pressure indicators have been installed near the junction of the high-pressure and district mains so that the valveman at Woodford may regulate the initial pressures to maintain the required pressures in the district mains.



The 4-in. main to South Chingford was laid in 1919, owing to the difficulty of maintaining the supply to that area through the low-pressure mains, and a 10,000 c.ft. per hour Bryan-Donkin rotary compressor direct coupled to an 18-h.p. National gas engine was installed at Woodford to pump gas through the main at pressures up to 8 lbs. per sq. in. The following year it was found necessary to improve the supply to Loughton, and the 8-in. main was laid for that purpose. It was thought at the time that there would be rapid development at Loughton, especially as there was a proposal to electrify the railway to that district, and therefore a main of fairly large capacity was selected.

The decision to supply Loughton as well as South Chingford at high pressure involved an increase in the size of the compressing plant, and a building was erected in which it was proposed to install compressing units of a total capacity of 80,000 c.ft. per hour. As it was estimated that the larger volume of gas would be required for Loughton, the maximum pressure to be worked was not expected to exceed 8 lbs. per sq. in.

The 10,000 c.ft. compressor and engine were transferred to this building in 1921, and a second compressor of similar type but capacity 20,000 c.ft. per hour with 18-h.p. gas engine was installed, belt drive through a common countershaft being arranged so that each engine could be used for either compressor.

In 1922, it was found that building in South Chingford was proceeding more rapidly than had been anticipated, and it was necessary to provide for larger main capacity or higher pressures. After obtaining tenders for compressors suitable for 30,000 c.ft. per hour at 30 lbs. per sq. in., and giving careful consideration to the capital and running costs of this plant, it was decided that an additional 6-in. main would provide a more economical solution, and this main was therefore laid that year. The laying of this main enabled the pressures to be reduced to about 3 lbs. per sq. in., and an additional compressor of 30,000 c.ft. per hour capacity, but of similar type to the previous sets, was installed in the following year, the countershaft being extended and an additional 18-h.p. gas engine erected. These additions enabled a satisfactory supply to be maintained during the next three years, the development at Loughton not having taken place as expected.

A fourth compressor, capacity 40,000 c.ft. per hour, was installed in 1926, a 36-h.p. engine being provided and the countershaft extended so that this engine could be used in conjunction with the smaller ones.

For some time, difficulty was experienced with the countershaft drive connecting all the units, and this drive was modified in 1927, ball bearings being provided, and the shafting split up so that each engine drove one compressor only. While this made a better job mechanically, it limited the pressure that could be worked on the 30,000 c.ft. compressor owing to the engine power being low. No difficulty with this was experienced at the time, however, as pressures above 6 lbs. per sq. in. were not required.

* This account formed the subject of a paper before the London and Southern District Junior Gas Association.

During this period, the maximum output had been steadily increasing, and the compressor capacity was insufficient to allow of one of the larger machines being out of action—at times of maximum load—for repairs. It was therefore decided to change the two smaller units for two of 30,000 c.ft. capacity each, and this was done in 1929-30, it being intended to install more powerful engines at a later date.

In 1930, it became evident that provision for considerable increases in the demand at South Chingford must be made. The number of consumers had increased since 1925 from 5200 to 7700, and the development of estates comprising 1300 houses had just commenced. Careful investigation was made of the various ways in which the extra consumption might be met. Rough estimates of the cost of providing local storage, either low-pressure or high-pressure (static holders), were prepared, and the laying of an 18-in. main, so that the supply might be given at relatively low pressures by boosting, was also considered; but it was finally decided that additional compressing plant should be installed and that the demand should be met by increasing pressures on the existing high-pressure mains as required.

The existing compressors were of ample capacity for the weekday load and for the Sunday load on the Loughton district. The extra capacity was therefore only required for the Sunday mid-day load on the Chingford district, and it was for this reason that the provision of additional compressors working at higher pressures was decided upon as the most economical solution of the problem.

It was arranged that provision should be made for an increase of approximately 100 p.ct. above the then maximum demand of 60,000 c.ft. per hour. Units of 40,000 c.ft. per hour capacity were selected, so that the complete installation would consist of four sets, three running and one stand-by. The first three of these sets have now been installed, two being supplied by The Bryan Donkin Company, Ltd., and the third by Messrs. George Waller & Son, Ltd.

The Bryan-Donkin sets each consist of a twin cylinder, double acting compressor, having a capacity of 40,000 c.ft. per hour against a pressure of 30 lbs. per sq. in. when running at 400 r.p.m., driven through a friction clutch by a 4-cylinder National vertical gas engine developing 100 h.p. at 440 r.p.m. This speed provides for a 10 p.ct. overload (volumetric).

The Waller set comprises a "Michell" crankless compressor, 8-cylinder single-acting driven through a clutch by a "Gardner" 4-cylinder vertical gas engine (type 4 K.M.). This machine has a rated capacity of 40,000 c.ft. per hour at 500 r.p.m.

All three sets are provided with loaded by-pass valves which may be regulated for any pressure from 10 to 30 lbs. per sq. in., and governors operated by the outlet pressure are fitted to the engine so as to provide automatic regulation of engine speed over a wide range. The compressors are also provided with unloading gear by which governing may be effected. The engines are arranged for compressed air starting, storage cylinders and a small air compressor being installed.

Each set is provided with a tachometer graduated in revs. per minute and c.ft. per hour, and an "Electroflo" meter with indicator and integrator is fixed in the common outlet main so that the volume being pumped may be measured.

This plant, a photograph of which is reproduced in fig. 1, was brought into operation last September, and is proving satisfactory. The maximum pressure required so far is 13 lbs. per sq. in., and the maximum output 85,000 c.ft. per hour.

RICHMOND HIGH-PRESSURE SYSTEM.

This system of mains is shown on Plan No. 11, and consists of approximately 5300 yards of 8-in. main from Richmond Works to Ham with a 6-in. branch to St. Margaret's Road, Twickenham, governors being installed both at Ham and St. Margaret's Road.

The first section of the system was the part 8-in., part 6-in. main to Twickenham, which was laid in 1926 in order to improve the pressures in that area at peak load periods. The low-pressure mains supplying Twickenham were fed from Southall and Brentford, the principal main being that from the former works; and for some years difficulty had been experienced in maintaining an adequate supply through these mains. Two boosting stations had been installed on the main from Southall and further increase of the capacity of the main in this way was not practicable.

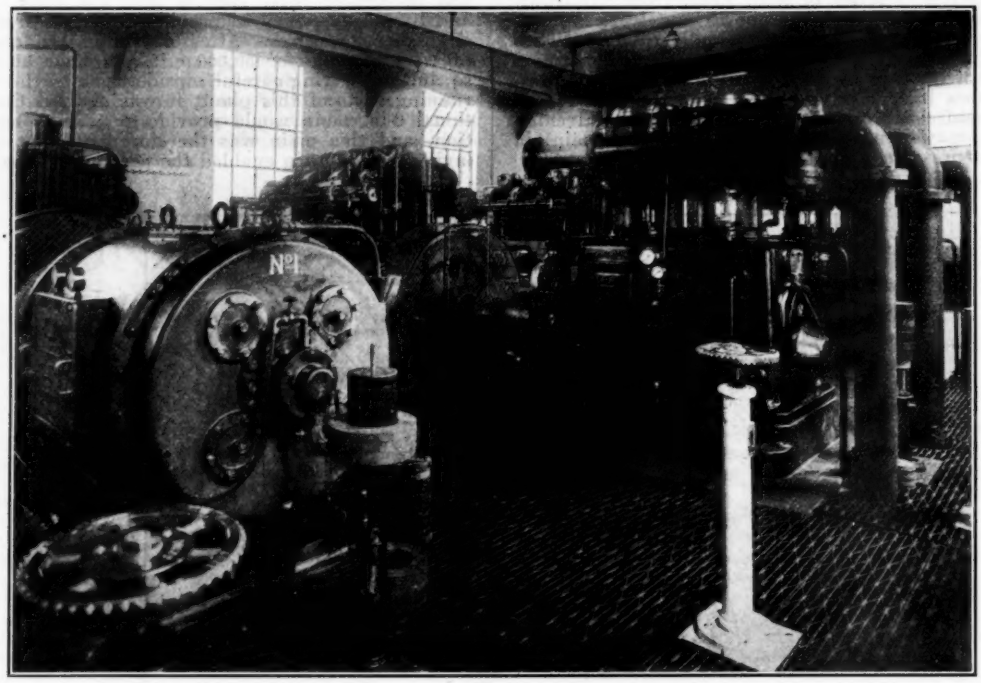


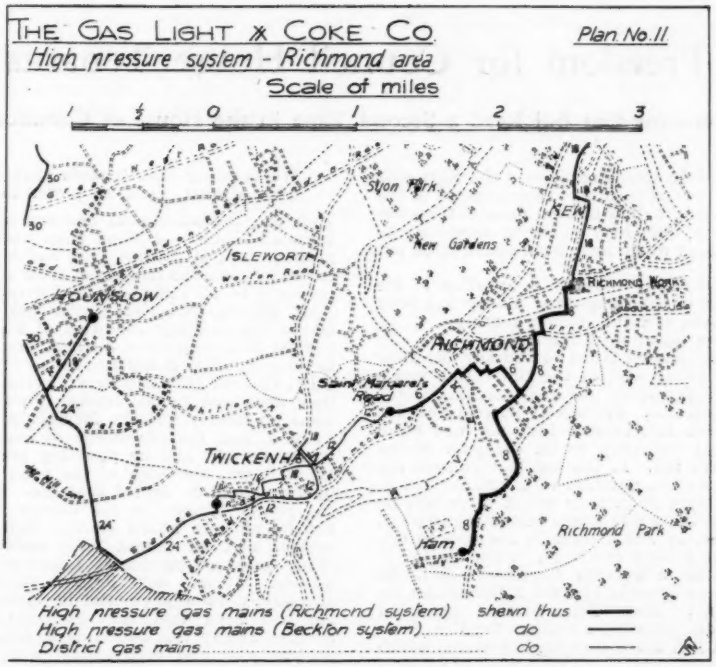
FIG. 1.

The lack of pressure at Twickenham was only serious at the periods of maximum demand, a few hours weekly, and it was therefore decided, immediately after the amalgamation of the Brentford Company, to lay down this high-pressure main as a temporary measure, until such time as the more permanent but costly remedy of laying additional trunk mains could be applied.* The 8-in. extension to Ham was laid in 1927, in order to provide an additional supply for the Ham and Petersham area.

The scheme, as first drawn up, provided for compressing plant at Richmond of a capacity of 75,000 c.ft. per hour at a pressure of 5 lbs. per sq. in., and it was proposed to install four 25,000 c.ft. per hour compressing units, one as spare.

Three sets of rolling-drum type rotary compressors of Messrs. Reavell & Co.'s manufacture were installed, these being of their R. 12 by 12 size, each of a capacity of 25,700 c.ft. per hour at 5 lbs. per sq. in. pressure; but before

* As stated before, a 24-in. trunk main was laid to Twickenham in 1930, but the St. Margaret's Road governor is still kept in use to ensure an even pressure at the east end of that district.



the fourth set was ordered, it was decided that the capacity of the plant should be increased, and therefore a larger size of compressor, R. 18 by 18, giving an output of 75,000 c.ft. per hour was obtained for this set.

These compressors are all direct-coupled to 3-cylinder vertical gas engines by Messrs. Norris, Henty, & Gardner, the three smaller sets having engines of 17 B.H.P. at 800 r.p.m., and the large set an engine of 42 B.H.P. (625 r.p.m.).

A photograph of this installation is shown in fig. 2, from which it will be seen that the units are very compact.

The pressures worked on these mains are varied according to the demand, the maximum pressure at present being 100 in. W.G., and the pressure being reduced to holder pressure at night.

(To be continued.)

REVIEWS

A CANADIAN FUEL SYMPOSIUM.*

Reviewed by T. CAMPBELL FINLAYSON, M.Sc., M.I.Chem.E.

Fuel has formed the subject of many Conferences during the past few years. London, Berlin, Tokio, and Pittsburgh have been the meeting-ground at various times of those particularly interested in fuel. It is therefore not to be wondered at that Canada should wish to hold its own conference, and with this in view the McGill University organized a symposium on the present knowledge of coal and fuel in Canada. A number of experts from many parts of Canada were invited to present papers on different aspects of fuel technology. The outcome of the conference is the volume of proceedings which is the subject of this review.

In a foreword, Sir Arthur Currie, Principal of McGill University, makes it clear that the object of the symposium was to present to the Canadian public, and especially those engaged in the coal producing and coal consuming industries, a picture of the actual position in the Fuel Industries and of the technical and economic difficulties involved in their development. The eight papers which were contributed, together with the statistical appendix, form a valuable monograph on Canadian Fuel, and McGill University may be congratulated on causing these papers to be presented.

Dr. E. S. Moore discusses the origin, physical character, and distribution of Canadian coals. He shows that Canada has about one-sixth of the world's coal resources. Although there is this abundance of coal, it is situated far from the main centres of population. Prof. Edgar Stansfield deals with the chemical composition and classification of Canadian coals. In his contribution the author urges the need of world agreement on coal classification, although he regards this as improbable in the near future. In the meantime Canada and the United States are working together and are likely to reach agreement. Mr. J. J. Humphreys writes on the subject of gasification, including coal gas, water gas, and producer gas. In the limited space available the author is only able to treat his subject in a very general way. The High-Temperature Carbonization of Coal is discussed by Mr. A. T. Leavitt, whose attention is almost entirely confined to bye-product coke ovens.

A particularly interesting summary of the present position of low-temperature carbonization is given by Mr. C. Tasker. Into some ninety pages the author compresses a very great deal of useful and detailed information on the many processes which have been, or are being, tried. Full recognition is given to English projects. The relation of petroleum and its allied products to coal, and the relation of electricity to coal, form the subjects of further contributions. Prof. Lesslie R. Thomson reviews some of the economic aspects of the Canadian coal problem, illustrating his argument with a number of graphs and tables. He shows that, were Canada to embark upon a policy of an all-Canadian supply for Canadian needs, the increase in her coal bill over and above what she would spend in an absolutely free coal market would be from 40 to 60 million dollars per annum. Owing to the inherent difficulties and complexities of the coal situation, he urges the establishment of a National Fuel Commission having jurisdiction over the whole Canadian coal and fuel industry.

The volume concludes with an appendix giving analyses of Canadian coals from the various fields. Each of the contributions is well illustrated and supplemented by a useful bibliography. To anyone wishing to understand Canada's fuel problems the book may be heartily recommended.

* Proceedings of the Symposium on Fuel and Coal. McGill University, Montreal, October and November, 1931. Price $1.50, from the Bursar of McGill University, Montreal, Canada.

TRANSACTIONS OF THE SENIOR ASSOCIATIONS.

The 1931 edition of the Transactions of the Associations of Gas Engineers and Managers is now ready. The book covers the work of the nine Senior Associations, and includes a full index to papers and authors, in addition to complete membership lists of the various bodies, including officers and committees. The price is 11s. 3d. post free.

Freedom for Council House Tenants

Kettering Gas Bill Read a Second Time in the House of Commons

On March 14 the House of Commons considered the Kettering Gas Bill on the motion for second reading. One proposal of the Bill is to prevent the Kettering Urban District Council from imposing conditions that only electricity shall be used in the houses and streets in that area which have been constructed out of public funds.

Lieut.-Col. WATTS-MORGAN (Lab.) moved the rejection of the Bill because a large amount of the ratepayers' money had been spent on the electricity works and the council housing.

Mr. MCENTEE seconded the rejection of the Bill.

Mr. R. G. CLARRY (U.) said he had failed to find any adequate reason for the artificial agitation against the Bill. This was a question of freedom for the supply of gas and freedom for the tenant to have it if he wanted it. There was no cost entailed to the local authority if this Bill became law, nor was there any obligation on the local authority or on the part of the tenants of the estate to have gas. In the last Government the Minister of Health stated, on the question of discrimination in council houses, that there were 90 p.ct. in which there was no question of injustice, so that there was only a remaining 10 p.ct., of which Kettering was one, in which there is a desire to discriminate adversely against a local company. As a matter of fact, there was one precedent to warrant the present Bill. In 1925 the Newport Corporation brought forward a Bill asking for certain powers with regard to land. Prior to that there had been a tendency to show discrimination against the Gas Company in Newport. In that Bill there were certain words which might be held to give a statutory confirmation of what they had been doing in the past, and the local Gas Company asked for an explanation and to have the matter put right. They took it to a Committee of the House, and the Committee imposed a certain clause. The House ought to know what the clause was, because it constituted the precedent which was said not to exist. The clause was:

> The Corporation shall not make or impose under the powers of this section any term condition or restriction with respect to the form of light heat power or energy to be used in any house shop office warehouse or other building or on any lands or with respect to the taking by any particular local authority company body or person of any form of light heat power or energy.

The Gas Industry had 10,000,000 consumers and probably served 13,000,000 people. It had not troubled Parliament unduly during the past. Acts of 1847 and 1871 were rightly passed when gas was a monopoly. It was no longer a monopoly; it was subject to the fiercest competition, and yet a number of those old provisions remained to-day. It would be in the interests of the country, of the consumers, of the public generally, and of better service if that matter could be dealt with at some future date.

FEELING IN KETTERING.

Mr. EASTWOOD (U.) said he had tried to ascertain the general feeling in Kettering on this Bill, and it was, "Let the tenant have his own choice; it is up to the tenant to make up his mind." Indeed, as far as he could ascertain, the Urban District Council itself was not unanimous in opposing this Bill. There were members of the Council who held the popular view that the tenant ought to make his own choice. The Gas Company supplied about 50 p.ct. of the Council houses in Kettering. As far as he could ascertain, they gave good and cheap gas, and they were prepared to supply the extra houses without putting any charge on the local authority. That was a most important matter, for it meant that whatever happens with regard to this Bill, there would be no charge put on the local authority. The London County Council recognized that, and they allowed their tenants to have either electricity or gas. As far as Kettering was concerned, there was the utmost good feeling between the Municipality and the Gas Company.

Mr. WILL THORNE (Lab.) said there were a large number of local authorities who had both the gas and the electricity in their areas under their control, and as far as he knew not one of them had placed an embargo upon their tenants using either gas or electricity, but let them have both. The Kettering local authority had no right to put an embargo upon its tenants using gas. He was the Vice-Chairman of the Joint Industrial Gas Council, upon which there were representatives of municipalities and representatives of private companies, and men were represented who were working not only at gas-works, but also at generating stations, and they had had to take into consideration the position in a number of places where local authorities had placed an embargo on the tenants using gas, or *vice versa*, and they had to enter an energetic protest. That was as far back as 1928. At that date the joint National Gas Council passed this resolution:

> This Council views with concern that in certain cases local authorities, by inserting conditions in leases have interfered with the liberty of choice of the tenants in determining what form of heat, light, or power they shall use. We consider that tenants should be free to use whatever form of heat, light, or power they desire to use.

That was the unanimous decision of the Gas Council. On the Borough Council of West Ham they had 58 Socialist Labour members out of 64, but they had never attempted to place an embargo upon the tenants of their council houses, and they had the right to use either gas or electricity.

Mr. BRIANT (N.L.) suggested that, provided the tenant maintained the sanitary condition of his house and did not offend against the amenities of his neighbours, he should have the right to do as he liked in his own rooms for which he had paid.

Dr. HOWITT (U.) said he was certain that, for whatever reason they were sent to this House, it was not to add to the restrictions on liberty. Every Member of this House, if he lived in London, had the advantage of being able to use either electricity or gas, and he probably used them both. He did not think it was the wish of the country that anybody who was poorer should be denied that use. If this Bill was not passed, the poorer tenants in the council houses at Kettering would not be able to afford electric light, and would have to use candles and oil lamps. He spoke as a doctor who spent many years of his life in Lambeth, working under such conditions. It was very difficult indeed for a doctor to attend adequately to any patient in distress under such conditions. He had been told that in certain council houses in this country to-day this condition of affairs again existed, and that doctors who had been called in to confinement cases had to carry on their work by the spluttering light of a candle. That was a monstrous thing to happen in these days. He was very keen, in supporting the Bill, that such a fate might not await the poor tenants of the council houses at Kettering.

Sir A. STEEL-MAITLAND (U.) thought that any tenant, where the opportunity could be provided, ought to have the choice as to whether he should have either gas or electricity, or both. The great majority of people were convinced that, while electricity was, perhaps, better for lighting purposes, for heating and cooking gas was preferable.

INTERFERING WITH PRIVATE RIGHTS.

Capt. NORTH (U.) said it was a most monstrous thing that any local body should interfere with the private domestic rights of the citizens in this matter. The Gas Company did not wish to compel the tenants in these council houses to take gas, but they said that they should be able to supply them with gas if they wanted to have it, and they also said that they saw no reason why a council, a county council, or a district council, or any other body, should be allowed to stop them from supplying gas to anyone who wanted it. He therefore supported the Bill, because he felt that a great injustice was being done, not only to the Gas Company, but to the rights of private citizens.

Mr. LOVAT-FRASER (Nat. Lab.) called attention to what had been done by the London County Council. Up to March 31, 1931, the London County Council had erected over 52,000 houses, finding accommodation for 236,000 people. Since that date many other houses had been erected, and the total expenditure of the County Council on housing schemes had been about £40,000,000. On Feb. 17, 1931, the County Council passed the following resolution, and he would like the Kettering Council to take note of it and follow it:

> That as far as practicable it is desirable, provided that no additional charge on the rates is involved thereby, that equal opportunity should be given to gas companies and electricity supply authorities to install their services in the council's dwellings, and that the council's tenants should be afforded freedom of choice in the use, wherever available, of gas or electricity, or both.

THE ACTIONS OF ENLIGHTENED MUNICIPALITIES.

He would also mention Woolwich, which began badly but turned over a new leaf. In 1925 the Metropolitan Borough Council of Woolwich commenced the erection of a large housing estate known as the "Page Estate." In connection with that estate the Council passed a resolution that the tenants should not be permitted to take gas for any purpose. In spite of that fact, however, one tenant requested a supply of gas, and the South Metropolitan Gas Company, in accordance with their statutory obligations, afforded a supply. Notice to quit was immediately served by the Borough Council upon the tenant. That was probably what would happen in Kettering if any tenants of the council houses were to ask for, and to insist upon, a supply of gas. As the tenant refused to give up possession, a summons was issued in the County Court, but before the hearing of the summons the Municipal Reformers obtained a majority of two on the Woolwich Council. The Council immediately indicated that no steps would be taken against any tenants on the estate who took a supply of gas for any purpose. Since then the Woolwich Council had started a housing estate of 500 acres, and they had notified that the tenants on this estate were to have absolutely unrestricted freedom in the choice of the medium of heating, lighting, and

cooking which they desired to take. These were the actions of enlightened municipalities.

Mr. PIKE (U.) supported the Bill. He said that, if the Kettering Council were not afraid of competition, let them prove it conclusively by giving to the Kettering Gas Company the power to compete, and giving to the community of Kettering the right to choose for themselves which power they would use.

Mr. ERNEST BROWN (Parliamentary Secretary to the Ministry of Health) expressed the views of the Minister of Health. The Bill should go to a Committee of the House where the issues could be thrashed out, evidence heard on both sides, and a reasoned decision come to.

The motion for the rejection was negatived, and the Bill was read a second time.

FREE CARBON IN TAR

A Discussion from the Carbonizer's Viewpoint

[CONTRIBUTED.]

The so-called " free carbon " represents one of the most interesting and important of the constituents of tar. We cannot claim completely to understand the significance and functions of this material, but sufficient is known to cause carbonizers and tar distillers alike to take an interest in the conditions which lead to its formation. The importance of the conditions will be readily appreciated when it is realized that the free carbon content of high-temperature tars may vary between 3 p.ct. and 30 p.ct. The deleterious effects upon the working of the purification plant of excessive free carbon in the tar are well-known, the principal of these being the difficulty of separating water from the tar. The finely-divided character of the free carbon in tar makes it a powerful emulsifying agent, and this is particularly so when the free carbon content is about 10 p.ct. to 12 p.ct. In the mains, tar and water vapour condense together, and this coincident condensation in the presence of minute particles of carbon results in the formation of a stable water-in-tar emulsion in which the free carbon acts as a stabilizer. In the formation of emulsions, it is well known that the smaller the grain size of the stabilizing solid, the more stable are the emulsions until an optimum is reached, after which the very minute grains have inferior emulsifying properties. These very minute grains, however, will pass through filter paper and would escape in the normal process for the estimation of free carbon in tar.

As has previously been explained, it is the smaller particles which are particularly liable to be carried forward in the gas stream and condensed with the tar. It is also known that the greater the quantity of stabilizing solid, the greater is the quantity of emulsion formed, a factor which explains why high free-carbon tars cause trouble, whereas coke oven tars in which free carbon occurs to only a small extent give no difficulty in this respect. There are methods by which water-in-tar emulsions may be broken, as, for example, by centrifuging and by forcing the emulsion at a temperature of 160° Fahr. through an orifice at 80 lbs. per sq. in. pressure (*cf.*, for example, " Gas Age," November, 1924). Another method somewhat similar to the previous one is that of subjecting the tar to a heavy capillary pressure, while addition of paraffinoid oils to a high-temperature tar tends to precipitate the carbon. Since many tars from verticals are paraffinoid in character, the mixing of tars from various sources is apt to result in carbon deposits, and, at the same time, the water is separated.

PREVENTING THE FORMATION OF EMULSIONS.

The brief review of the method of separating water-in-tar emulsions here given indicates clearly that most of these methods are only practicable if the tar has reached the storage tank, and that none of them is practicable during the gas-making process. The obvious method of dealing with emulsions in the carbonizing plant is to prevent their formation. The first step is, therefore, to consider the nature of free carbon and the cause of its formation.

Free carbon may be derived from a number of sources. The most obvious of these is from the decomposition of tar-laden gases and vapours in the retort itself. The hydrocarbons other than methane are evolved from coal in the earlier stages of distillation, and tar condensable at normal atmospheric temperatures practically ceases to be evolved by the time the coal has been heated to 600° C.; the whole of the tar is completely evolved at temperatures below 700° C. The effect of heat upon the aliphatic primary tars is to convert them into aromatic bodies. Naturally during this decomposition some solid carbonaceous bodies may be formed, but—whether because the quantity is small or because the bodies themselves are of such a nature that they are soluble in the other constituents of tar—practically no free carbon, in the generally accepted sense of the term, is formed at lower temperatures. Coke ovens of the older type and vertical retorts, both of which are characterized by cool tops, produce a tar containing very little free carbon, whereas many horizontals and some types of modern bye-product coke ovens in which the upper portion of the retort is heated to a higher temperature are great sinners in this respect. The true primary tars obtained from the distillation of coal are light in specific gravity, and if submitted to very careful heat treatment in the presence of water and under laboratory conditions could, theoretically at any rate, be converted largely into benzene, toluene, and similar low-boiling aromatic bodies.

In the early days of the war when benzole and toluole were particularly valuable, it was believed that by suitably cracking creosote oil a high yield of benzene and its homologues could be obtained, and, indeed, it seemed quite feasible that by decomposing the complicated hydrocarbon bodies which comprise the higher boiling tar fractions the lighter tar fractions could be manufactured. Unfortunately, however, research showed that the effect of heat is to convert benzene into toluene and higher homologues, toluene into naphthalene, naphthalene into anthracene, and ultimately on further heating into carbon and water. That is to say, the tendency at higher temperatures is to produce more complicated aromatic bodies until ultimately these bodies become so complicated that they break down altogether. This is the simple chemical explanation of the characteristics of tar produced from an overheated retort, and explains the increased formation of naphthalene in these tars, together with the increased formation of free carbon.

COAL DUST AS A SOURCE OF FREE CARBON.

Coal dust mechanically carried out of the retort with the gases is another source of free carbon. Clearly the disturbance caused by charging, together with the up-rush of the heated gases, will tend to carry lighter particles of coal, frequently in a partly carbonized condition, out of the retort into the mains. This action is particularly potent when charging retorts or coke ovens connected to the main to prevent smoke nuisance. The lighter the particles the more readily will they be carried forward, so that any free carbon that may reach the gas mains, whether resulting from decomposition or owing its origin to mechanically borne particles of coal, will be in a very finely divided state. The significance of this point will be appreciated later.

Finally, there is a third method of formation of " free carbon " which may be a consequence of standing or may be the result of chemical condensations, which occur between the time when the tar leaves the retort and when it is cooled and put into the storage tank. These reactions, which result in the condensation of two or more molecules to form other higher boiling and ultimately solid bodies, reach their maximum in the tar still, and, more particularly in wrongly designed stills, may result in excessive quantities of free carbon and pitch. Adam and Sach (J.S.C.I., 1929, Vol. 48, p. 337 T) have investigated the formation of free carbon in this manner, and have made the interesting observation that, whereas a free carbon determination carried out by extraction with pyridine ap-

pears to result in the isolation of the true suspended matter only, extraction made with benzene or toluene gives a higher value, the bodies isolated consisting of true suspended matter *plus* bituminous resin-like compounds. These resin-like compounds are, generally speaking, those derived from those portions of the tar which are soluble in alkali. They appear to give rise to free carbon in pitch, particularly when the tar is subjected to prolonged heating or to excessive heat during distillation.

The material insoluble in pyridine may be regarded as the actual suspended matter in the tar or pitch, and while the tar distiller may be equally interested in both types of compound, and particularly in the ratio between these compounds before and after distillation, the practical carbonizer is only interested in the true suspended matter. The resin-like bodies can be diminished by increasing the temperature to which the tar is subjected in the retort, but the true suspended matter is thereby increased. It is not yet quite clear what is the real significance of the resin-like bodies even from a tar distiller's point of view, but there is no doubt about the significance of the true suspended matter from a carbonizer's point of view. Consequently this discussion can be confined to the true suspended matter. Too much of this constituent of tar is definitely undesirable, and means must, therefore, be taken to avoid its formation in excessive quantities. A certain proportion of free carbon is necessary in pitch if it is to be a good binding material, and also for the same reason in road tar; but since it is almost impossible to avoid the formation of some free carbon in high-temperature practice, no particular notice need be taken of this factor by the carbonizer except possibly when operating certain vertical retorts, although, in this case, any deficiencies which the pitch may have in binding properties are more likely to be associated with the other constituents that are contained in the tar than in its deficiencies as regards free carbon.

Nature of "Free Carbon."

It is interesting to notice, and would, indeed, be expected, that free carbon is not pure carbon. Donath and Asriel (Chem. Zetr., 1903, p. 1099) have examined the free carbon and have found it to consist of 89·2 p.ct. carbon, 2·3 p.ct. hydrogen, 3·7 p.ct. nitrogen, and 7·13 p.ct. oxygen. A very similar result has been obtained by Adam and Sach (*loc. cit.*). The same authors, moreover, record that a particular specimen of insoluble matter obtained by extracting pitch with benzene and CS_2 contained 12·45 p.ct. volatile matter, whereas the same insoluble matter when extracted further with pyridine only contained 7·3 p.ct. volatile matter. The fact, however, that the "free carbon" contained 7·3 p.ct. volatile matter was evidence that it is very far from consisting wholly of elemental carbon.

The true insoluble matter comprising free carbon is, therefore, to be regarded as derived (*a*) from decomposition of hydrocarbon gases in the retort, and (*b*) from particles of coal and coke carried upwards with the escaping gases. Particles carried mechanically will principally tend to be carried during the first hour of carbonization when the gas evolution is the most violent and the coal has not yet been carbonized save in the layers immediately against the retort wall. The velocity of the gases, together with the disturbance caused by the charging, must have a dominating effect upon this occurrence. The obvious method of reducing both these factors is to reduce the temperature of the retorts. This step may be quite a possible one in the case of coke ovens, particularly since it is only the temperature at the top of the oven which should be decreased. It is not, however, always possible in the case of horizontal retorts. This subject has been investigated by Hollings (J.S.C.I., 1926, p. 406 T). Hollings mentions particularly four carbonizing conditions which have an influence upon the free carbon content of the tar—namely, temperature, duration of heating, ingress of air into the retort, and size of the retort. So far as temperature is concerned, Hollings concludes that any attempt to improve the quality of an unsatisfactory tar by reducing the combustion chamber temperature would appear to necessitate a reduction of the temperature below that required for the maintenance of such throughputs of coal as are essential for economical working.

The time spent by the products of distillation in the retort must be of importance though there is no obvious *a priori* reasoning to show how great is the significance of this factor. The rate of most of the chemical reactions that occur during carbonization appears to follow the monomolecular law, and the rate of formation of free carbon would thus decrease with increasing time allowed for the reaction. Since, however, the total time spent by any molecule in the retort is only a matter of seconds, the time factor would be expected to assume great importance. The time spent in traversing the coke and reaching the free space will be fairly uniform, since the area available for gas flow is small and the velocity must be great. Moreover, the deeper the retort, the greater is the quantity of gases passing. The governing factor is the volume of the free space lying above the charge. The results quoted by Hollings (*loc. cit.*) show clearly how marked is the effect of the extent of the free space upon the free carbon content of the tar. When the total weight of coal charged was progressively decreased from 35·5 to 29 lbs. per c.ft. of retort space, there was an increase in the free carbon content of the tar from 12·1 p.ct. to 20·8 p.ct. It may not be very far from the truth to suggest that the total free space in the retort was, for example, 7 p.ct. in the case of the 35·5 lb. charge, and that it had increased to 24 p.ct. in the case of the 29 lb. charge.

Air Leakage in Retorts.

Leakage of air in the retorts is a very potent source of free carbon, since, as is shown by the common observation of a smoky flame, the first effect of incomplete combustion is liberation of carbon. This carbon, moreover, is in a peculiarly finely divided condition, and is readily carried through the plant and condensed with the tar. Not only is the quantity of free carbon increased by incomplete combustion, but it is also increased as a result of the local overheating which may occur due to the combustion.

It has also been suggested by Hollings that the smaller the horizontal retort the lower is the free carbon content of the tar produced therefrom, and he states that this observation "suggests that it is easier to obtain tar of low free carbon content from the smaller sizes of retorts." There may, however, be some differences of opinion regarding this particular observation, since when one goes to the extreme in size—that of the coke oven—the free carbon content of the tar is generally a good deal less than that from a horizontal retort. Everything appears to depend upon the temperature of the top of the retort or coke oven, upon the extent of the free space, and upon the method of charging.

The principal factors which have been recognized as affecting the free carbon content of the tar are thus temperature of the retorts, size of the free space, and leakage of air into the retorts. These three factors principally affect the formation of free carbon by decomposition of hydrocarbons, but there is also the additional factor of the most minute particles of the coal being carried upwards by heated gases. To these may be added a further factor that does not appear to have been considered hitherto—namely, the action of the ash of the coal and of the material composing the retort. The effect of the composition of these bodies upon such reactions as the decomposition of ammonia has been found to be particularly important, more especially as regards their iron oxide content. Is it not possible that the composition of the inorganic constituents inside the retort may be equally powerful in regard to free carbon production?

The conclusion is thus reached that, in order to prevent excessive free carbon production, the retort must be well filled to lessen the time of heating of the gases, and the pull on the retort must not be such as will draw in free air at the ends, but reduction in temperature of the retort by reducing the combustion chamber temperature is not feasible since the throughput of the retorts would become too greatly decreased.

Carbonization of Wet Coal.

There is, however, a further method of reducing the free carbon formation which also does not yet seem to have suggested itself to gas engineers and that is by the carbonization of wet coal in place of dry coal. Water would influence the coal charge in several ways. In the first place, the dry, dusty coal now used in many gas-works would be definitely improved because the cloud of fine dust particles created in the retort when first charging—and which subsequently settles on the top of the coal or is carried up the ascension pipe—will be prevented from forming. In the second place, the violent initial evolution of gas will be lessened. In the third place, the extra heat absorption caused by passage of water vapour along the top of the charge will cool the free space. Finally, the extra volume of gases and vapours caused by the vaporization of the water will so lessen the time that the gaseous products spend in the heated retorts that the extent of decomposition will be materially reduced. The heat consumption required for evaporating the water need not be a matter for any undue alarm. The water is partly evaporated directly and is partly driven into the interior of the charge, but the first quantity of water added up to possibly even as much as 10 p.ct. of water does not result in increased fuel consumption, because this water is evaporated largely by the sensible heat of the gases and not by the direct heat of the fuel used in the producers.

THE "JOURNAL" TECHNICAL RECORD

Which contains Reports of Meetings of Gas and Allied Associations

Complete Gasification in Vertical Retorts*

By M. Barash, Ph.D. and T. A. Tomlinson, M.B.E., M.Inst.Gas E.

Very early in the history of steaming in continuous vertical retorts the possibility that the new process might be extended to complete gasification was realized. The idea was that coal would be fed into the top of the retort, while steam would be admitted in such quantity at the bottom that only ash would remain to be discharged.

In the Fourth Report of the Research Sub-Committee of the Gas Investigation Committee of the Institution of Gas Engineers of May, 1920, Dr. Parker reported two tests made at Uddingston "with the object of ascertaining to what extent it is possible to gasify coal inside the retort by the action of steam." The second of these tests was carried on until the mass of ash left in the retort became so refractory that the coke extractor mechanism was unable to deal with it. It was estimated that a yield of about 95,000 c.ft. of gas at 305 B.Th.U. gross calorific value was obtained per ton of coal charged, or 290 therms, without deduction of "under-firing" or producer fuel. The tests showed that complete gasification could be effected, but that it was not practicable as a continuous process.

In the first of the two tests, however, "coke was extracted continuously at the lowest possible rate." The estimated yield of gas was 47,500 c.ft. per ton with a gross calorific value of 338 B.Th.U., or 160 therms per ton. The solid residue extracted at the base of the retort contained 38 p.ct. of the carbon originally present in the coal, and this was a process that could, in a quite practical way, be carried on continuously.

When, therefore, the Research Department of West's Gas Improvement Company had the full-scale gas-works in operation at the Albion Iron Works, it was decided to take the first opportunity of going further into this matter. Obviously the first step was to explore the position theoretically. We assumed a coal with a gross calorific value of 14,000 B.Th.U. per lb. and we assumed that this coal would yield per ton 13,000 c.ft. of gas at 540 B.Th.U., and that the dry coke produced would be 13 cwt. per ton. This 13 cwt. was to provide the whole of the carbon converted into gas by steaming *plus* the fuel requirements of the setting.

Previous experience had led us to believe that "38 p.ct. of the carbon originally present in the coal" would be more than sufficient for under-firing requirements, and we decided to calculate to what point it would be possible to gasify the carbon in the coal so as to leave just sufficient fuel for the requirements of the settings. In other words, we were going to steam to the point at which there would be no "coke for sale."

The calculations, then, are as follows:

Data with Dry Distillation (Steaming Curve 3).

Yield per ton of coal	13,000 c.ft.
Calorific value of gas per c.ft.	540 B.Th.U.
Calorific value of coal per lb. (dry)	14,000 ,,
Coke per ton of coal	13 cwt.

(All gas measurements at 60° Fahr. and 30 in. bar., moist.)

Steaming to the Limit.

Let V = total gas made per ton.
A = cwt. of coke used as fuel.
B = cwt. of carbon converted to water gas by steaming in the retort

A curve showing cwt. of coke used as fuel, plotted against gas made in c.ft. per ton is a straight line curve represented by the following equation:

$$V = 10{,}500A - 10{,}700 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (a)$$

Carbon used in steaming = 15·6 lbs. per 1000 c.ft. of water gas, from the theoretical equation $C + H_2O = CO + H_2$.

"Added gas" when steaming to the limit = V − 13,000 c.ft.

$$\text{Carbon consumed} = \frac{V - 13{,}000}{1000} \times 15{\cdot}6 \text{ lbs.}$$

$$\text{or B} = \frac{(V - 13{,}000)\ 15{\cdot}6}{1000 \times 112} \text{ cwt.}$$

$$\therefore V = 7180\,B + 13{,}000 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (b)$$

Subtracting equation (*b*) from equation (*a*) we get $10{,}500\,A - 7180\,B = 23{,}700$ . . . . . (1)

But, when steaming to the limit, A + B = 13 . . . . . (2)

∴ From (1) and (2)

A (producer fuel) = 6·62 cwt. (742 lbs.)
B (carbon converted in retort) = 6·38 cwt. (714 lbs.)

Substituting for A in equation (*a*), V = 10,500 A − 10,700 = 58,800 c.ft. (total volume of gas made).

To find C, the calorific value, at the limit, assume a constant calorific value of 300 B.Th.U. per c.ft. for the "added" water gas.

Then $58{,}800\,(C - 300) = 13{,}000\,(540 - 300)$ C = 353 B.Th.U. per c.ft.

Summary of Results.

Steaming to the limit, we have per ton of coal carbonized:

Volume of gas made	58,800 c ft.
Gross calorific value	353 B.Th.U. per c.ft.
Carbon consumed in steaming	6·38 cwt. (714 lbs.)
Coke used as fuel	6·62 cwt. (742 lbs.)

Heat Balance (at the Limit).

Coal—
Heat of combustion of 1 ton of coal = 14,000 × 2240 B.Th U. = 31,400,000 B.Th.U.

Gas—
Heat of combustion of gas per ton of coal carbonized = 58,800 × 353 B.Th U. = 20,800,000 B Th.U.

Steam—
Coke to producer.
Assume ash content of coal = 8 p ct (dry basis) = 179 lbs. per ton of coal.
Coke to producer per ton of coal = 742 lbs.
Ash content of above coke = 179 lbs. = 24·2 p.ct.
Carbon content of above coke = 742 − 179 = 563 lbs.
Water-gas reaction—

C	+	H_2O	=	CO	+	H_2
12		18·016		28		2·016
1		1·501		2·333		0·168

That is to say, for every 1 lb. of carbon consumed during steaming, 1·501 lbs. of steam are decomposed. Therefore,

Steam decomposed = 714 × 1·501 = 1070 lbs.
Steam decomposed as p.ct. of coal carbonized

$$= \frac{1070}{2240} \times 100 \text{ p.ct.} = 48 \text{ p.ct.}$$

So that, assuming 50 p.ct. conversion, the steam required at the limit is 96 p.ct. by weight of coal treated. And steam required per ton of coal carbonized

= 2240 × 0·96 = 2150 lbs.

* Abstract of a paper before the North-Western Section of the Institute of Fuel, Manchester, March 18.

Assuming an efficient waste-heat boiler:

Steam raised from and at 212° Fahr. = 5·8 lbs. per 1 lb. of carbon.
Steam raised per ton of coal carbonized = 5·8 × 563 = 3260 lbs.
Heat required to generate 1 lb. of steam from and at 212° Fahr. = 970·7 B.Th.U. (1).
Heat required to generate 1 lb. of steam at 30 lbs. per sq. in. abs. pressure, superheated to 300° Fahr. from feed water at 60° Fahr. = 1191 − (60 − 32) B.Th.U. (1) = 1163 B.Th U.
Then equivalent steam raised under above conditions per ton of coal carbonized when steaming to the limit = $3260 \times \frac{970{\cdot}7}{1163}$ = 2720 lbs.
Total heat of steam raised = 2720 × 1163 B.Th.U. = 3,163,000 B.Th.U.
Total heat of steam absorbed by fan (5 p.ct. of steam raised = 136 lbs.)* = 136 × 1163 B.Th.U. = 158,000 B.Th.U.
Total heat of steam used by exhausters, pumps, &c., say, 15 p.ct. of steam raised—*i.e.*, 408 lbs. = 408 × 1163 B.Th U. = 475,000 B.Th.U.
Total heat of steam used for steaming = 2150 × 1163 B.Th.U. = 2,500,000 B.Th.U.
Total heat of excess available steam (2720 − 136 − 408 − 2150 lbs. = 26 lbs.) = 26 × 1163 B.Th.U. = 30,000 B.Th.U.

* The actual steam used for fan power may be as much as 20 p.ct. of the steam raised when a turbine drive is used, but as most of this is recovered by feeding the exhaust to the retorts the net quantity of steam absorbed at this point is no more than 5 p.ct.

TAR—

Referring to the results obtained when steaming Wigan Arley coal of similar quality to that assumed in these calculations[2] the tar yield is as follows:

P.Ct. Steaming on Wt. of Coal.	Tar (Dry) Gallons/Ton of Coal.	Spec. Gravity of Tar.
6	11·3	1·072
8	16·9	1·072
14	23·6	1·090
24	22·1	1·075
31	21·8	1·080
52	25·2	1·085

It will be observed that there is little increase in the yield of tar above 14 p.ct. steaming, and the specific gravity shows only a very slight tendency to increase. It appears fairly safe to assume that, with 96 p.ct. steaming, the yield would be approximately 25 gallons of tar at a specific gravity of 1·1.

Weight of tar per ton of coal = 25 × 1·1 × 10 lbs. = 275 lbs.
Gross heat of combustion of typical dry tar = 9300 cal. per grm. = 16,700 B.Th.U. per lb. (3)
Heat of combustion of tar produced per ton of coal carbonized when steaming to limit = 275 × 16,700 B.Th.U. = 4,590,000 B.Th.U.

HEAT BALANCE FOR RETORT SETTING ON 1 TON BASIS WHEN STEAMING TO THE LIMIT.

—	B.Th.U.	P.Ct.
Heat input—		
Heat of combustion of 1 ton of coal	31,400,000	100
Heat output—		
Heat of combustion of gas	20,800,000	66·3
Heat in steam used by exhausters, &c.	475,000	1·5
Heat in available excess steam	30,000	0·1
Heat of combustion of tar	4,590,000	14·6
Heat loss (by radiation, in waste gases, ancillary plant, &c.)	5,505,000	17·5
	31,400,000	100·0

Thermal efficiency = 100 − 17·5 p.ct. = 82·5 p.ct.

It is interesting to note that as the residual coke is totally absorbed in the fuel requirements, so the steam raised by waste heat from the settings is also practically completely absorbed when the limit is reached.

It may be objected that the residual coke after so much steaming would be so high in ash content that it would be useless in producers. But that is not the case. As the authors have several times pointed out, the action of the steam on the coke does not penetrate far below the surface of the individual pieces. The carbon is gasified on the surface and the ash is left in a fine skeleton or powder which falls away on disturbance and appears mainly in the dust or fines after screening.

The effect of these calculations is shown on fig. 1, which is here reproduced. The diagram is practically self-explanatory. The dotted curve in the upper portion is No. 3 of the "West Steaming Curves" given in our report of the Pittsburg paper, which we reproduced on p. 93 of our issue of Jan. 13. The bottom half of the diagram shows what happens to the coke, each of the arrows indicating the increase in the quantities required for extra fuel to the producers and for conversion into water gas until "coke for sale" disappears at the right-hand side of the diagram.

To illustrate their point with regard to the ash content of the coke, the authors referred to p. 79 of the "Results in Glover-West Vertical Retorts" published by West's Gas Improvement Company, and to show how the actual results obtained in steaming to the limit had been in correspondence with the calculations they referred to p. 77 of the same publication.

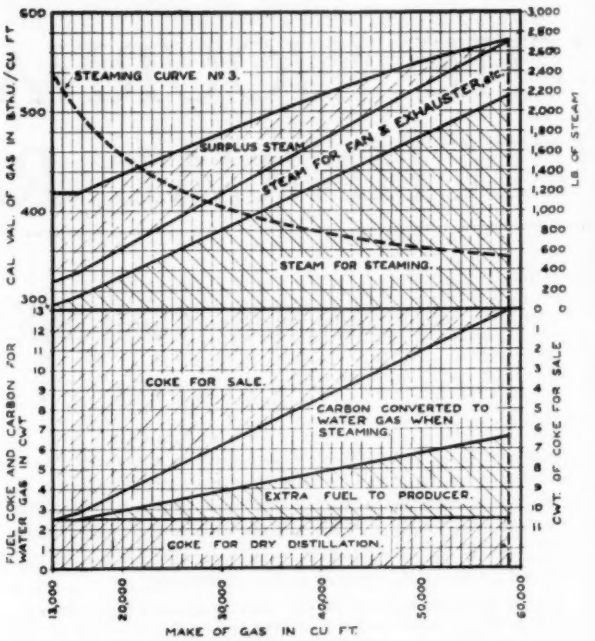


Fig. 1.

The paper concluded with the following paragraphs relating to costs of production:

COSTS—

The question of the cost of gaseous therms produced on this basis will be adequately illustrated if an extract is given of a recent proposal to use gas for steam raising in connection with power production. The unit under consideration was one requiring the supply of a maximum of 21,600 therms per day, and it was estimated that plant capable of producing this, including vertical retorts, coal and coke handling plant, waste-heat boilers, purification plant, a gasholder of sufficient storage capacity, together with all buildings and foundations, could be built for £200,000.

The cost per therm would work out somewhat as follows:

COST PER THERM AT MAXIMUM CAPACITY.

Gas made, say, 200 therms per ton at 355 B.Th.U. per c.ft., 21,600 therms per day.

	£ s. d.
Coal—	
21,600/200 = 108 tons, at 20s.	= 108 0 0
Residuals—	
Tar 25 × 108 gallons = 2700 gallons at 2d.	= 22 10 0
Ammonia	Valueless
Net coal cost	£85 10 0
Labour—	£ s. d.
9 men at 10s. 6d. per shift	4 14 6
3 foremen at 12s. 6d. per shift	1 17 6
1 technical man at £1 per day	1 0 0
Maintenance, 108 tons at 1s.	5 8 0
	£98 10 0

This is equivalent to 1·09d. per therm, to which is to be added capital charges. This would be represented by something like 12½ p.ct. per annum on £200,000 (= £25,000 per annum)—*i.e.*, £68 10s. per day, or 0·76d. per therm.

Total cost per therm = 1·85.

It is, of course, true that the cost per therm of raw coal is very much less, but we were able to point out that there were considerable advantages which, to our mind, made our proposal attractive. We eliminated coal-handling, ash-handling, and mechanical stokers from the boiler house. The maintenance costs of all these plants, particularly in the case of the furnace, would be much heavier than those involved in the combustion chambers and machinery of the retort settings.

No one is as yet making gas in practice steaming to the extent suggested above, but the authors venture the opinion that there is more than one set of circumstances in gas-works practice or in heat production generally, where these suggestions deserve serious consideration.

REFERENCES.

1 "The Callender Steam Cables."
2 p. 77 from a publication by the Research Department of West's Gas Improvement Company, entitled, "Results in Glover-West retorts."
3 "Technical Data on Fuel," p. 185.

Coal Constitution and Carbonization*

By Dr. R. Lessing

The selection of coals for gas-making purposes has been and is still made on entirely empirical lines; the type or types which have been found to give the best economic carbonizing results in any particular locality and with the available kind of plant are chosen on the basis of practical experience in commercial use and in certain cases after passing them, in limited quantities, through test plants fashioned as models of the large-scale operation. The value of a coal is quite properly assessed on the products obtained from it under the ordinary works conditions.

Until 20 or 25 years ago the available methods for examining coals were practically limited to their proximate and ultimate analysis, and for carbonizing work the estimation of volatile matter was regarded as a useful, though admittedly inadequate, guide.

"Volatile matter" is a generic term comprising both the gaseous and liquid products, the latter including the moisture in the coal and the water formed on carbonization, obtained on heating coal in the absence of air. It does not give any indication of their relative proportion, and taken by itself and without other knowledge of the character of the coal is really of little value in showing the products likely to be obtained on the large scale.

An Electrically Heated Apparatus.

In 1911, in some work carried out for the purpose of improving the customary crucible test for volatile matter, I devised a new method by the use of an electrically heated cylindrical silica tube in which the coal is heated in a confined space under the pressure of a silica piston. This apparatus was found useful in the general study of the carbonizing process, particularly as it permitted to separate gas from tar and liquor and gave coke residues which were much more characteristic of the coals tested than the coke buttons made in the platinum crucible.

The method, which has now been incorporated in the British Standard Specification for the analysis of coal permits, *inter alia*, the ascertainment of the expansion of a coal in a gas retort or coke oven and conclusions as to the physical properties of the coke obtained. The difference in volume of the cokes from one gramme each of twenty different coals is very striking, while their sections give an indication of their internal structure. The results from any one coal are constant, and the peculiar mushroom shape of cokes characteristic of some coals gives an insight into the sequence of reactions and phenomena taking place in the carbonizing mechanism, such as coke formation, assumption of rigidity, de-gasification, &c. If we inquire into the reason for the variation in the behaviour of different coals under identical conditions of treatment, we are forced to ascribe it to the difference in their composition or constitution.

Our knowledge of coal constitution until about fifteen years ago was very scanty. Modern constitutional research may be said to have begun with the recognition by Dr. Marie C. Stopes in 1919 of four characteristic compounds in ordinary banded bituminous coal—vitrain, clarain, durain, and fusain.

Vitrain and clarain form together bright coal, durain mainly dull coal, while fusain is the peculiar, friable portion occurring mainly in lenticular inclusions, formerly known as mineral charcoal or mother-of-coal. These terms have been applied to the respective components as indicating their general appearance to the naked eye, and their identity can be established on palæo-botanical grounds by examination of sections or polished and etched surfaces (Seyler) under the microscope. Since the early chemical characterization of the four components by Tideswell and Wheeler and the study of their mineral constituents and of their behaviour on carbonization by Lessing, much valuable work has been done in this country and abroad on the botanical, physical, and chemical properties of these main constituents of bituminous coal.

In order to understand and appreciate the behaviour of coal during its utilization and particularly upon carbonization, it is essential to study its inner constitution and that of its main components, and no better way of doing this can be suggested than to visualize the mode of formation from its vegetable raw material.

The biological, chemical, and geological influences which converted large accumulations of plant material by gradual decay through the stages of peat and lignite into bituminous coal and eventually into anthracite, mainly by loss of water, carbon dioxide, and methane, are by no means fully understood, but there is already a fair amount of chemical evidence which at any rate indicates the differences of character in the four groups, even if it does not yet permit us to formulate definite conclusions as to the reasons for them. The general character of a coal will be determined largely by the relative proportions of the main components present in it.

It must, however, be recognized that these components are by no means comparable to individual chemical compounds. They must be regarded, in the first instance, as mixtures of plant fragments and plant products in varying stages of degradation.

Vitrain.

For instance, vitrain is probably wood or woody fibre which has gone through such an intensive process of degradation or digestion that it formed at one time a colloidal jelly-like mass, which eventually hardened to a material golden brown in thin sections which is either entirely devoid of morphological structure, or shows residual plant fragments in indistinct, though recognizable, outline.

Clarain.

Clarain is formed from a similar vegetable raw material, but the degradation has not proceeded as far as in vitrain, with the result that it still contains in a matrix of vitrain-like material a mass of plant fragments or entities, such as spores, cuticles, &c., which are easily recognized and even identified under the microscope.

Durain.

Durain, the dull and hard component, has little or none of the colloidal ground mass, but consists of a magma of small plant fragments closely knitted together, and intermingled with mineral matter consisting principally of clay substance, and indicating that the plant material was originally deposited together with a clay mud.

Fusain.

Fusain has definite wood structure, and is probably derived from a raw material similar to that of vitrain and clarain, but by a different process of coalification.

In the endeavour to elucidate the chemical composition of coal with the ultimate object of isolating individual chemical compounds from it, its extraction by solvents has been favoured by many investigators. The method usually employed is to submit coal to a powerful solvent, and then subdivide the extract by less powerful or more specific solvents so as to obtain portions of different chemical characteristics. The products obtained vary according to the solvents and working conditions employed, and are grouped according to different terminologies which involve overlapping and make direct comparison difficult, if not impossible. Thus, Wheeler and his collaborators, by the successive use of pyridine and chloroform, subdivide the coal into alpha, beta, and gamma compounds. Fischer, Bone, and others use as the first solvent benzene under pressure, the former dividing into oily and solid bitumens, the latter into numbered fractions from which compounds have been actually isolated.

Francis and Wheeler, by their "rational analysis," subdivide coal into three main groups: (1) The resins and hydrocarbons, extractable by solvents; (2) the ulmins obtained by oxidizing the residue with a mixture of nitric acid and potassium chlorate and removing the oxidation products by means of alkali; and (3) the plant remains which are resistant to oxidation.

While vitrain, clarain, durain, and fusain represent groups of one kind, mainly of a botanical and biological nature, the products obtained by solvent analysis and oxidation are also merely group types, but of a chemical kind. In certain cases the chemical groupings have been applied to the former, but in all other cases much of the very laborious chemical work would have gained in analytical value if the raw material employed had been the mechanically separable components instead of their average mixture as present in raw coal.

Apart from the study of the major components or groups which make up the coal conglomerate, it is important to consider the degree to which the coalification of the original vegetable material has progressed. In general, it may be assumed that this conversion proceeded through the stages of peat, lignite, and various classes of bituminous coals to anthracite. By the elimination of water, car-

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bon dioxide, and possibly methane, the carbon content gradually increases, while that of oxygen decreases. These stages determine the " rank " of coal, a lignite being a coal of low rank, anthracite one of the highest rank. Modern coal classifications, such as Seyler's, are based on the distinction of rank as shown by the carbon, hydrogen, and oxygen content, which express themselves also in the corresponding percentages of volatile matter or calorific value. The " rank " of coal practically signifies its commercial applicability. It increases roughly in the order of long-flame steam coals, gas coals, coking coals, smokeless steam coals, anthracite. It is to be hoped that any generally accepted commercial classification of coals will be based on their determinable character, although this pious wish is as yet far from fulfilment. It must be recognized that the suitability of any coal for a particular purpose is dependent on many factors which cannot all be easily expressed in a rigid system. One need hardly be reminded that in a single branch such as gas making, a fairly wide diversity of coals can and, with different carbonizing systems, must be used.

Constitution and Carbonization.

It is obvious that the great variety of coal constituents according to their proportion and arrangement to each other must influence carbonization very considerably. The feature which saves the carbonizing process itself, as distinct from the understanding of its mechanism, from excessive complexity is the fact that it simplifies the constitution of its raw material by completing Nature's carbonization of plant material. By substituting high-temperature treatment for the more subtle agencies employed by her, the time required for the preparation of a smokeless fuel in the gas retort is reduced from millions of years to a few hours; but it must be conceded that we have to improve our methods very considerably before ordinary coke attains the excellence of Nature's final carbonizing residue, anthracite.

Fundamentally this is by no means impossible. If coal in small particles is heated very gradually by raising the temperature in stages not exceeding 50° C., maintaining it at each temperature so long that all volatile matter released at that temperature is driven off, a residue is obtained which by outward appearance is almost indistinguishable from the original coal. The particles retain their original angular form, bright surfaces, and black colour, show no sign of fusion, and generally have not the structure of coke. In order to obtain this result, it is, however, necessary to keep the coal at each temperature for days or even weeks at a time, and it is therefore obvious that commercially this result is unattainable, particularly if applied to sizes larger than, say, 1/10 in.

Such a method of gradual heating is valuable in that it avoids all secondary reactions and permits the liquid and gaseous products to be obtained in logical sequence. Up to 150° or 200° C. occluded gases are evolved, followed just above 200° C. by small quantities of water and oxides of carbon. Between 200° and 310° C. an oil is obtained which is probably preformed in the coal and distils practically unchanged. Actual decomposition of the coal substance begins at 350° C., yielding large volumes of gas, consisting mainly of paraffin hydrocarbons and oxides of carbons, and increased amounts of water of decomposition, together with a thick tar containing phenols characteristic of the decomposition of ulmins and hydrocarbons produced from the resinous compounds. Tar formation is complete at about 450° or 500° C., but gases continue to be evolved in increasing quantities, their rate of evolution rising further above 700° C. when hydrogen becomes the chief constituent of the gas.

If coal, on the other hand, is heated rapidly, as in commercial carbonization, considerable overlapping takes place between these reactions, and at the same time the coal itself, as it still contains tar-forming constituents, undergoes a fusion or lignation process which results in the formation of what we know as coke. The formation of coke structure may be regarded as completed at 500° C.

Application of Heat.

The overlapping of the various stages is even more complicated in practice than in laboratory work with small quantities. In the first place, the application of heat to the different parts of a retort charge varies owing to the low conductivity of coal. Further, it must be considered that the tar and pitch released in one part of the retort, say, near the walls, is partially condensed on the coal in the cooler parts. In intermittent working the portion of the charge which reaches carbonizing temperature at a time when another portion is already completely coked will be modified in its composition by the deposition of tar on the surfaces of the coal practically forming a solution of coal in tar. The raw material is therefore somewhat different from the original coal. In continuous retorts the conditions are similar, but the changes occur in topographical arrangement rather than according to periods of time—that is to say, some tar is deposited in the upper zones and a modified coal reaches the carbonizing zone proper.

These phenomena applied to coal as a whole are complex enough, but the conditions are further complicated if we consider that the whole mass consists of the various identifiable components discussed under the heading of constitution.

How much these components differ from each other, particularly in the type of coke obtainable from them, was shown in a study of the behaviour on coking of vitrain, clarain, durain, and fusain. It was found that vitrain and clarain are the principal coke-forming constituents, that durain while slightly coking under ordinary conditions must be regarded as a " filler," which, however, gives rigidity and possibly strength to coke, while fusain by itself has no coking power at all. Recent work has, however, shown that fusain in small quantities, when homogeneously mixed with coal may influence the strength of coke. Cokes were prepared from these constituents separated from Hamstead coal and carbonized at 600° and 900° C. Vitrain coke has a mushroom formation which is of particular interest. It is due to the overlapping, previously mentioned. Obviously, the layers adjacent to the retort wall became coked and assumed rigidity before the heat penetrated to the interior. When the inner core became decomposed the gases evolved, burst open the semi-plastic top layer and escaped, the conical top becoming coked to the outer cylinder during the completion of its carbonization.

Mineral Constituents.

An important item in the many and varied compounds and groups of materials which go to make up the conglomerate of coal is the mineral constituents. In the first instance it might be useful to stress the fact that, while we are accustomed to speak of the ash of coal, the mineral constituents are really present in coal in a form and combination different from that in which they exist eventually in the residue resulting from incineration. A true picture of their composition is therefore not obtained from the result of the analysis of an ash. The researches of the last 12 or 15 years have, however, made it possible to draw some very definite conclusions on the composition, distribution, and significance of mineral matter in coal.

It has been found that the amount and particularly the chemical composition of the ash of the coal component is characteristic for each. It may even be said that there is a close connection of the mineral matter with the formation and constitution of these compounds.

The examination of many coals from this point of view has shown that vitrain and clarain contain only from 1 to 2 p.ct. of ash which must be considered as the original plant ash; durain contains from 6 to 10 p.ct. consisting, apart from a small amount of plant ash, mainly of clay substance which is derived from the clay mud in which the macerated vegetable material was deposited from which durain was formed. Fusain contains from 10 to 15 p.ct. of mineral matter, largely composed of calcium and iron carbonates deposited from the water which percolated the coal seam and absorbed in this porous material.

The composition of these ashes shows remarkable differences. Vitrain and clarain ash contains a large proportion of water soluble and a fair proportion of acid soluble matter; fusain a large proportion of acid soluble matter; while in durain ash only a small proportion is soluble in acid, the bulk remaining insoluble.

It is most important from the practical point of view to realize that the ash content of the combined coal substance is very low indeed, ranging from 1·5 to 3 p.ct. in most good gas coals. The balance between these figures and the usual ash percentages which may be anything from 8 to 15 p.ct. is made up by extraneous mineral matter derived from the rocks of the roof and floor of the coal seam and from dirt bands and consisting mostly of shale, pyrites, and calcite.

The presence of avoidable ash in coal is probably the most serious factor militating against the production of a coke of the highest possible quality. A high ash content in coke causes blanking of the fire, thus impairing complete combustion and a high output of radiation, and it leads to clinkering which is one of the blemishes which make the general adoption of this otherwise most valuable smokeless fuel such a slow process. The presence of avoidable mineral matter is also objectionable in every respect during the carbonizing process, both from the economic and technical points of view.

The ash question in relation to carbonization has been discussed on many occasions, and I have recently dealt with it in detail in a paper submitted to the First International Gas Conference in June, 1931.

The obvious and simplest way in which to improve the quality of coke is the removal of the ash-forming con-

stituents by cleaning the coal before carbonization. The rational method by which a complete removal of the objectionable impurities of gas coals is based on the constitutional difference in the coal components and on the recognition that the bulk of the mineral matter is present in raw coal in a mechanically free and detached form. With this knowledge and on this basis a process has been worked out which, briefly, involves the removal by pneumatic means of the natural dust containing nearly all the fusain, and the subsequent gravity separation of the clean coal from the shale, pyrites, and other refuse, in a bath of calcium chloride solution. The clean coal, comprising mainly clarain and vitrain, can at the same time be freed of the durain and inter-grown particles, of which usually a small percentage only is present in gas coals.

The process has been described repeatedly, and in the paper above referred to operating data were given, together with an account of comparative tests carried out at Tottenham Gas-Works with several hundred tons of coal before and after cleaning by this process.

One of the most striking results was the difference in the sizing, ash content, and general appearance of the coke made from the cleaned and uncleaned coal, and the very considerable advantages obtained from the clean coke in water gas-making were explained in detail.

A few simple experiments, together with specimens of the cleaning products and gas produced, will show the crux of the process and its bearing on carbonizing work more clearly than any description I can give.

Some outstanding points are that the percentage of large coke from clean coal is greatly increased while the percentage of breeze is halved. Further, while the ash content of the coke from uncleaned coal rises with decreasing size to nearly 26 p.ct. in the breeze, the ash in four coke grades from clean coal remains constant at the remarkably low average figure of 3 p.ct.; hence, even the breeze will be, though small, a high-grade fuel. The quantity of ash left in the open grate or in a domestic boiler is quite insignificant and the fire of a " clean " appearance. Tests carried out at H.M. Fuel Research Station showed that the clean coke gave a very high maximum rate of radiation considerably above that of the coke from uncleaned coal. More recent tests carried out at Leeds University by Mr. H. J. Hodsman gave similar results showing that when applying his method for comparing the behaviour of carbonized fuels in an open fire grate the clean coke gave a higher output of heat, and consequently a higher heating capacity of the appliance, that it required less gas in ignition and produced a considerably smaller amount of carbon monoxide in the upper zones of the fire.

Some of the advantages in the water gas process are:—

The whole coke can be used without screening.

A minimum of clinkering work is required and a hand-operated set was actually run for 47 hours before the first clinker was withdrawn.

In the same test the steam requirements were reduced by 27 p.ct. and the gas make increased by 39 p.ct.

Economic calculations have shown that all the advantages of " clean " coke can be obtained without any charge to the operating expenses by savings in a number of directions.

I feel convinced that before very long the incessant call for cleaner coke will be met by the Gas Industry, and the employment of coal of the lowest possible ash content will contribute more than any other factor towards capturing the domestic and industrial market for smokeless fuel and thus free the Industry from all anxiety for the disposal of its solid product, while, at the same time, adding to the efficiency of its manufacturing processes.

Discussion.

The PRESIDENT (Mr. J. Howard Goldsmith), in opening the discussion, said that he thought very few of them knew a great deal about coal, and as they had an expert with them that evening they should take the opportunity of learning all they could. In the cleaning of coal quite a lot of matter was brought out, and he wondered what the effect of this was on the catalytic action of gas making. From a table which Dr. Lessing had shown them they saw how the addition of a catalyst affected the coke yield and the gas yield. Did it affect one way or the other the gaseous thermal yield? He was also interested in what Dr. Lessing had said in regard to carbonizing coal to make coke or anthracite. Could they assume that the natural process evolved throughout centuries was a semi-carbonizing of coal to form anthracite? Referring to the matter of fractures, where these occurred in a reasonably straight line, did they take place along the " bedding plane? " They were able to appreciate the advantages of Dr. Lessing's test apparatus over the crucible test, and it was remarkable what strides had been made in the testing of coal by means of the Lessing apparatus.

Dr. LESSING stated that this matter of the effect of coal cleaning on the catalytic action was a problem which had not yet been fully explained. A considerable amount of work had been done on the effect of certain catalysts upon coal, particularly by Prof. Cobb and his school, following earlier work by himself. So far actual work had not been done to show to what extent the difference in the coke and in the gas yields was due to catalyst or to the removal of foreign matter pure and simple. Undoubtedly present views on the formation of anthracite were that it had been formed by a very slow and gentle process of carbonization; but it must be borne in mind that in a process of this kind extended time might be substituted for elevation in temperature. In pottery work, for instance, they knew that similar results could be obtained at lower temperatures when firing over a long period as by firing at a higher temperature over a shorter period. This was analogous to the question of anthracite formation over millions and millions of years. In regard to fracture, this undoubtedly took place in the case of ordinary bituminous coals, particularly the softer kinds containing clarain and vitrain. The breaking took place along these lines which were in contact with the mineral matter. They would occur not only in the " bedding plane," but also at cracks of a vertical kind which had occurred in the coal at one time, and since filled by mineral matter largely consisting of calcium and iron carbonate. These mineral portions formed a line of weakness along which the coal would break.

Economic Breaking Limit.

Mr. F. A. SANDERS (South Metropolitan Gas Company) said that he took it that the refuse contained a certain amount of combustible matter. Also, he understood that the samples shown were the sizes to which the coal was broken. Was it desirable to break the coal up into smaller sizes, or was there an economic limit to the breaking?

Dr. LESSING explained that the refuse did contain combustible matter, though it was naturally mainly ash—about 75 p.ct. Some of the balance was water, and the remainder would be carbon. But refuse was carbonaceous and was actually used for steam-raising purposes, though this could only be done on the colliery where there were no transport charges. For carbonizing purposes it was absolutely useless, as tests available indicated that it did not contain any clarain or vitrain nor any caking properties. So while they could use it, where there were no transport charges involved, for steam-raising purposes, it was no use for coke making. The reason why uncleaned coke made a great deal of breeze was bound up with this question of refuse. Wherever there was a particle of refuse, the coke would not adhere and became friable. In regard to the size to which coal should be broken, Dr. Lessing said that there was no need to break it at all. By breaking coal further the advantage gained was only very slight. One could obtain a very little more clean coal, but it amounted to hardly more than 1 p.ct., while the cost of breakage had to be borne, in addition to the fact that breaking coal created more dust which had to be extracted. Therefore it was better to take the coal straight from the screens and treat it directly.

Mr. H. WADSWORTH (Tottenham) inquired what means there were of disposing of the dust obtained as a result of the Lessing coal cleaning process.

Dr. LESSING said that the ideal channel into which the dust should be directed was coal dust firing. Dust had very little caking power, and was therefore not very useful for carbonizing, although there was some modern work according to which a small portion of fusain was supposed to improve the strength of metallurgical coke. However, the ideal way was to fire it as dust, the advantage being that there was no need for pulverizing.

Spongy Coke.

Mr. R. B. TUNSTALL (Tottenham) remarked that it had been his privilege to help work Dr. Lessing's plant for some days, and it did work in a remarkably efficient manner. In regard to clean coke, he had been doing a little work on cokes primarily for burning in the ordinary open coal grate, and in his own grate at home clean coke had been very successful. He had tried the addition of a small quantity of dust, which gave quite satisfactory results in conjunction with the coke. There was, however, one drawback. In trying a number of types of coke in the open grate, it seemed that the best domestic coke was one which was not quite even in structure. What was needed was a higher proportion of dense coke with small pores, together with a certain amount of spongy material to help to give the fire a good start. Clean coal furnished coke of a far more even texture than uncleaned coke, and if it were possible to make a clean coke which also contained a certain proportion of this spongy material it would be very good. He wondered if Dr. Lessing had evolved a method of doing this.

Dr. LESSING remarked that Mr. Tunstall had first-hand knowledge of some of the tests carried out with his process. In regard to his preference for an uneven or partly spongy coke, Dr. Lessing was not certain whether he entirely agreed with this. Work carried on at Leeds by Mr. Hodsman had shown results which were definitely in favour of even sizing in order to obtain the best radiation efficiency—a property greatly sought after in the open grate. He believed that the advantage found in a certain proportion of spongy coke was rather more in the direction of ignition and not so much in the running of the coke fire continuously. This was a point of some importance but not greatly so, because it had been found that this coke, while easy to ignite and of high reactivity, was not so valuable from the radiation point of view. It was therefore rather a question of helping the ignition of the even cokes by means of gas devices, and once they were ignited they were more satis-

factory for keeping going continuously, provided they were not poked; and they gave a high radiation efficiency.

Mr. TUNSTALL further remarked that these patches of spongy coke were most useful in lighting up the fire. There was also another point in regard to radiation. He would rather have a cheerful fire of 32 p.ct. radiation efficiency than an efficient fire of 34 p.ct. radiation; and where one had some proportion of this spongy coke one obtained a little flickering flame on the top of the fire which looked much nicer than the glow from the even type of coke. If he used perfectly even coke he had 1 or 2 in. of flame and the general appearance was not unlike a high-temperature radiator. On the other hand, where there was a small amount of spongy coke, not only did it burn through very quickly, but there would be a flame 8 in. long on the top; and although he knew he was wasting money up the chimney, it improved the appearance of the fire.

THE LOVE FOR THE OPEN FIRE.

Dr. LESSING, in reply, said that the question of flame was bound up with that of carbon monoxide, and both at Leeds and at the Fuel Research Station they were particularly endeavouring to avoid this. It would be a long time before the Englishman's love for the open fire and flames would be quenched; but with the extending use of gas fires and electric radiators a new generation would be springing up which would be very pleased with the appearance of this radiating surface and would not grieve for the dancing flame. The more efficient fire would be regarded as the more pleasing. After all, the same effect could be obtained by putting some coal on the coke fire.

Mr. G. H. ROGERS (Gas Light and Coke Company) inquired if the cleaning of coal had any effect in reducing the sulphur content, firstly in the gas and secondly in the coke.

Dr. LESSING stated that it had a considerable effect in reducing the sulphur content by extracting the bulk of the pyrites. At the same time, one must not run away with the idea that by taking out the sulphur the percentage of sulphur in the clean coal would be greatly reduced. There were cases of coals high in organic sulphur where by taking out the shale the organic sulphur became more concentrated. One had also to consider that per charge one used less coal and therefore less sulphur-bearing material. The sum total was that the sulphur percentage from a coal fire might be less by 15 to 25 p.ct., and the same applied in the case of gas making. Dr. Lessing said that in his calculations he had allowed a fraction of a penny less for purification charges.

Mr. E. F. STEPHENS (South Suburban Gas Company) inquired whether it would not be possible, when in the first part of the process the dust containing fusain and mineral matter was being separated, to retain or recover the fusain from the dust; he considered that the fusain was a fairly valuable product. When Dr. Lessing had spoken of the distillation of coal by slow degrees surely the final product would vary in structure from the original product. When he mentioned a saving of 1s. 3d. to 2s. 6d. per ton on cleaning, was he assuming that he was going to obtain a better price for the final coke?

Dr. LESSING replied that in the de-dusting process it had so far not been possible to fractionate either the coal dust from the mineral dust or the fusain from the ground coal substance. The air velocities were too sensitive, and experiments had often been made which had proved abortive. The de-dusting process was operated rather on size than on specific gravity. If one had a shale particle and a coal particle together it was impossible to separate them.

The structure of the coal heated by slow degrees was physically about the same so far as one could judge from external appearances; the internal structure was bound to be altered.

In regard to the matter of profits, undoubtedly allowance had been made in the sale price of the coke, but only to the extent of the calorific value; no credit had been taken for the other advantages. The price had merely been assessed as between the clean coke and the uncleaned coke. The coke salesman should be able to get considerably more for the attendant advantages of clean coke, but even at the same price there would be a considerable saving.

WATER CONTENT OF COKES.

Mr. H. H. BROWN (Southampton) asked if Dr. Lessing had any figures to show whether there was any difference in the amount of water in cokes from ordinary and from clean coals.

Dr. LESSING stated that the moisture contents of cokes were of course, not a function of the coke structure except to a small extent, but were rather a function of the treatment of the coke during quenching. At the same time, he had found moisture figures with a small bias in favour of the cleaned coal. Under the same conditions the smaller sizes of uncleaned coke were the more moist, due to their containing a proportion of dust which retained moisture. Clean coke breeze was practically of the same physical structure as the large and would not contain more moisture. Breeze production was largely bound up with the content of non-coking material in the coal. By putting shale dust in the coal one added to the tonnage, but it always came out in the wash again.

Mr. S. H. MILES (Reading) said that he had not had any experience with Dr. Lessing's coking apparatus, though he had had some experience of the Gray-King plant, and he had found, roughly speaking, that there were three types of coal—the non-swelling, the medium-swelling, and the highly-swelling. The first type almost always produced coke not of a first-class quality. They found that the medium-swelling produced the best coke when put through a vertical retort installation. Highly-swelling coal produced a light coke which handled rather badly. He asked if he was right in assuming that the medium-swelling coal was rich in clarain and if the non-swelling coal had a high percentage of durain. He considered the Lessing cleaning method superior to coal washing. In conclusion, he inquired if it would not be possible to dispose of the refuse, which added to the cost of the coal cleaning.

Dr. LESSING said that Mr. Miles was correct in assuming that the non-swelling coal would be richer in durain, the highly-swelling coal richer in vitrain, while coal of medium-swelling capacity would be richer in clarain. But it was not entirely a question of swelling properties; one might have a coal of a high oxygen content with the result that the swelling would be reduced. Experience proved that highly-swelling coals gave trouble in vertical retorts, particularly the highly-swelling Durham coals in early days. On the other hand, they would give no trouble in horizontal retorts where there was plenty of room for expansion. In regard to the disposal of refuse, one must consider that the colliery has to use a considerable amount of fuel for its own plant, and if refuse was available of that kind, and if arrangements were made to deal with it by suitable methods without incurring excessive transport charges by having the boiler halfway between the cleaning plant and the refuse tip, it was an advantageous proposition as it set free valuable coal for the market. In the economics of the matter the refuse was assumed to have no value, while actually there was a small balance on the credit side.

COAL SPLITTING.

In reply to Mr. N. P. BROADBRIDGE (Wandsworth), Dr. LESSING stated that coal split along certain planes where there were deposits from water consisting of ankerites. It occurred to him that by treating these very thin veins, like sheets of mica, with acid it should be possible to split the coal. One could also split coal by using a gaseous acid, and he recounted the results of his experiments with a cylinder of sulphur dioxide in a pit. The application was too local, however, as well as being too slow. But if one used acid of any kind one could split coal very easily into its various components.

Mr. P. H. P. SMITH (South Metropolitan Gas Company) asked what effect the size of the coal had on the production of coke buttons. It had been stated that anthracite was produced by the low-temperature distillation of other coals, and yet the ash content of anthracite was very low. Was there any evidence to show that there was any anthracite available made from bituminous coals? One speaker had referred to a coke fire losing efficiency up the chimney. He did not think that the radiation from flames was particularly low; it might be a comparatively efficient way of radiant heating. He was not so sure that one was losing so great an amount of radiating efficiency as one might imagine.

Dr. LESSING, in reply, stated that undoubtedly the size of the coal affected the structure of the coke buttons, as indicated by some of the cokes shown. One had to use sufficient imagination and experience to realize the significance of the alteration in the aspect of the particle. If one had a larger particle, this would have fused to some extent, and therefore the merging would not be the same. Where one had clean coal the surfaces adjacent to one another were clean, with the result that there was a considerable amount of mutual penetration, and the size question did not arise to the same extent in these cases. A great deal of the valuable work done in the last ten or fifteen years in experiments on sized coals was vitiated by the fact that raw coal was employed. They knew that shale in coal was of a definite grade, like the clean coal with which it was associated. They also had the dust question. If they had uniform material—*i.e.*, the cleanest material—without foreign matter—the question of size would be less important. Where they had a small slack of ¼ in. in size, interstices were not so easily bridged as in the more compact mixture. When the coal was free from dust it would allow the gas and tar to escape freely while they could not escape in the dusty coal. Some of this work would have to be repeated because the smaller sizes were contaminated with the dust unless special precautions were taken. Dr. Lessing also referred to the question of anthracite and the varying ash contents of that obtained from different parts of the country.

EVOLUTION OF HYDROGEN.

Mr. BROADBRIDGE, in the course of some further remarks, inquired if, when coal was heated slowly, there would be some evolution of hydrogen at a certain temperature.

Dr. LESSING replied that the temperature was actually about 700° C. when a mixture rich in hydrogen came off. That hydrogen was due to the decomposition of molecules, and it was not conceivable that there was any more absorbed hydrogen present after that temperature. The occluded gases were practically all given off at a temperature of 200°. In order to obtain the desired results the heating had to be done so slowly that there was practically no decomposition taking place at any stage which should not take place at that particular stage. By the time the temperature reached 350° decomposition commenced, but it was very gentle and only became violent after the coke had been formed.

Mr. L. W. ANDREW, B.A., B.Sc. (Gas Light and Coke Company), referred to the question of carbon monoxide production by an open coke fire. They had been experimenting on these fires—some designed to burn rapidly and others slowly—but no more than 0·005 p.ct. was given off which was of the order of that given off by a freely-burning coal fire. The brighter, more clearly burning coke fire had a higher radiant efficiency.

Where there were 1 or 2 in. of flames above the fire the radiant efficiency was increased, which he thought was due to the higher temperature of the body of the coke; he did not think it could be due to the actual flames. No luminous coal fire gave a radiant efficiency of more than 12 p.ct., while the coke fire gave an efficiency of something over 30 p.ct. In regard to the matter of even coke being easily ignited and burning well, they had found that a coke between a 1-in. and a 2-in. mesh would light easily with gas ignition in twelve to fifteen minutes and gave a really bright fire.

Dr. LESSING said that when he originally spoke of carbon monoxide production he was thinking of the tests of Hodsman at Leeds, where they took the carbon monoxide 9 in. from the grate, which gave them a measure of the completeness of burning. He thought that Mr. Andrew had answered the question as to flames.

SHAPE OF THE FUEL BED.

Mr. TUNSTALL said that a figure of only 2 p.ct. as the difference in radiant efficiency had been given by him. This question of flames from coke fires seemed to be governed by the shape of the fuel bed as much as by the structure of the coke. It should be explained to the consumer how to build up his fire so as to obtain the most pleasing effect and the greatest heat. By doming the fire one could obtain a cheerful flame, and this impinged upon the fireclay back of the fire and radiated out into the room.

Mr. F. O. HAWES (Tottenham) remarked that he thought it might be taken that Dr. Lessing's plant was a model of chemical engineering work. It seemed to him that the collieries required a certain amount of pressure in this matter of coal cleaning, for, making the usual excuses of insufficient capital, they were not getting on with it at all. It would seem that some co-operative scheme for the erection of plant in the north of the country and dealing with the coal there might give impetus to the matter.

Mr. STEPHENS suggested that it would appear from Dr. Lessing's remarks that the swelling of coal might have some relation to the gaseous yield in therms. Could the gaseous yield of coal be determined from the degree of swelling?

Dr. LESSING replied that he was afraid that this could not be done. There were not sufficient data to correlate the two phenomena. The swelling was a property of the solid part of the coal, and was not, so far as they knew, directly connected with the amount of gas evolved. It so happened that most swelling coals were good gas makers, but he did not think that one could deduce anything practical from this. During the last few years a great deal of work had been done on swelling, particularly from the coke oven point of view, where it had been found that certain coals had been swelling to such an extent that they deformed the coke oven walls. Steps had been taken to alter the bulk weight of the coal; allowing more interstices helped to a certain extent. He did not think that there was anything to record as to gas yield in relation to swelling coals. He could, however, quite conceive the difference in the gas yield resulting from a good swelling and a less swelling coal. As a rule the two went together.

Replying to Mr. B. L. KELHAM, Dr. Lessing said that it was difficult to say why progress in some industries marched more slowly than in others. This coal cleaning was a comparatively new thing, but he thought that it would not be very long before it would be taken up in a general way. He could not see that the Gas Industry could afford to go on putting coke on the market in its present condition, when they might improve the quality by cleaning.

VOTE OF THANKS.

The PRESIDENT said that Dr. Lessing's lecture had been a treat to all of them, and there was not one who had not learnt a lot that evening. The large number of points raised in the discussion testified to the enthusiasm displayed and the appreciation of the members. He called upon Mr. H. C. SIMS (South Metropolitan Gas Company), the Junior Vice-President, to propose a hearty vote of thanks to Dr. Lessing.

This was seconded by Mr. R. SUMMERSON (Luton), and Dr. LESSING briefly acknowledged.

Midland Junior Gas Association

Visit to Watson House

A party of members of the Midland Junior Gas Association, on Wednesday, March 16, 1932, paid a visit to London, when they were the guests of the Gas Light and Coke Company in a tour of inspection of Watson House, the Headquarters of the Research and Training Section of the Company's Sales Department.

The Association, under the Presidency of Mr. W. L. S. Spinks, of Birmingham, were welcomed by Mr. J. G. Clark, Manager of the Research and Training Section, and were given an opportunity of witnessing the very wide activities in research and training which are continually in progress at Watson House. Our readers are by now familiar with much of the work carried on at Watson House, so that the briefest mention of some of the most outstanding items of interest witnessed by the Midland Junior Association in the course of their visit will suffice to show how much they were able to learn of the Gas Light and Coke Company's methods.

RESEARCH WORK.

Research in ventilation and design of flue equipment was in progress, together with influence of the character of radiant heat from gas fires; improved methods of effecting heat transfer; conditions affecting combustion and satisfactory design of appliances. Central heating units, gas-operated refrigerators, and gas appliances of all types and designs pass through the laboratories for testing and possible improvements, while designs are drawn up, and several appliances now familiar to the Gas Industry have had their origin at Watson House.

Properties and merits of various thermal insulating materials receive attention, and also the character of enamel used on cookers, and the resistance to corrosion of the ice trays in refrigerators.

Testing is carried out on appliances using methods of heat competitive with gas.

All tubes and fittings for consumers' premises are carefully examined, gauged and tested under pressure in huge quantities before issue to the district staff. Experimental laboratories are maintained in conjunction with the constructional workshops and a showroom is set aside for industrial appliances.

TECHNICAL TRAINING.

Technical training is carried out in conjunction with classes arranged by the L.C.C. and other authorities and is encouraged in many ways. The training falls into three main categories:

First, some 360 gas fitter apprentices are undergoing a six years' indentured apprenticeship, leading normally to employment as gas fitters.

Secondly, public schoolboys of 17 or 18 are each year articled as staff pupils in the Gas Sales Department of the Company—a course of training which lasts for five years.

Thirdly, there are facilities for the instructional courses for fitters and all ranks engaged in the supervision or execution of practical work in the department, while all employees of the Gas Sales Department—the strength of which is about 5000—are encouraged to take suitable courses of technical and general education, at various Institutes in London. During the present winter over 2000 men and boys are attending such courses.

Special demonstrations are also arranged in connection with particular features such as water heaters, in order that inspectors, show room attendants, and others on the sales side of the Company may be acquainted with the latest developments.

A WELCOME TO LONDON.

At the conclusion of the tour of inspection, the visitors were entertained at tea by the Gas Light and Coke Company, when Mr. Clark spoke a few words of welcome to the Association. It had been a great pleasure, he said, to have the Association there that afternoon. It was a compliment to be visited by their friends in the Industry, and he hoped they felt that their afternoon had been well spent. He told them how sorry Mr. Stephen Lacey was not to have been able to come over to see them, but he had asked Mr. Clark to convey his good wishes to the visitors and express the hope that they had had an entertaining and interesting afternoon. There were various Junior Gas Associations up and down the country, continued Mr. Clark, each of which had their particular territory, and he thought it was the custom when they were visiting one another to pay courteous compliments. They were in this position on that occasion, for the Midland Junior Association had invaded the area of the London and Southern District Junior

Gas Association and they had with them the President of the London Association, Mr. J. Howard Goldsmith, who would give them a welcome to London.

Mr. GOLDSMITH referred to the fact that Mr. Clark himself had been a President of the London and Southern District Junior Gas Association some years ago. That Association had a very big area, and they were very pleased to see any of them from the Midlands when they could get down to London. He hoped they had enjoyed their visit, and any time they were down that way again, either collectively or individually, if they were to write to the Secretary of the London Association they would be very pleased to help them.

Mr. W. L. S. SPINKS, replying on behalf of the visitors, expressed thanks to the Gas Light and Coke Company, Mr. Clark, and others who had given them their time. They were most grateful to the Gas Light and Coke Company for extending this welcome to them that day. Watson House was unique in this country and, he supposed, the world. The members of their Association were drawn from various fields, and in each of these fields there had been something at Watson House which had been of particular interest to every one of them. The relative value of the varied experimental work struck each of them differently, but they all recognized the general and particular importance of each item to them. "Mr. Clark," said Mr. Spinks in conclusion, "on behalf of all here I do extend our thanks to you for your hospitality this afternoon."

NOTES ON PLANT AND PROCESSES

"Cyclone" Temperature Comparator.

The "Cyclone" temperature comparator, manufactured by Messrs. Beecroft & Partners, Ltd., of St. Peter's Close, Sheffield, is designed for the accurate measurement of the high temperatures commonly used in the various metallurgical processes of forging, hardening, case-hardening, annealing, &c. It differs from an ordinary pyrometer or pyroscope in that it is intended for the daily use of the workman in the shop, giving him a direct and simple temperature reading, without the use of complicated formula or technical calculations of any kind.

The principle consists of placing before the operator various coloured standards which are exact reproductions of the appearance of a part heated to any of the usual temperatures employed in the various heat treatment processes. The parts being heated in the furnace or Smith's hearth reach the desired temperature when they present exactly the same colour as that of the comparator standard.

The colours of the comparator are effected by the surrounding lighting conditions in precisely the same manner as the part being heated so that the accuracy of the comparison is unimpaired.

Neither lens or instruments of any kind are necessary, the local temperatures being read independent of furnace temperatures.

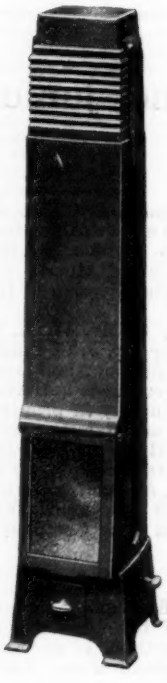
The "Cyclone" temperature comparator is particularly useful in hardening operations since it enables the comparison to be made while the part is actually out of the furnace, the temperature being allowed to fall to the requisite heat as shown by its colour, when it is immediately quenched.

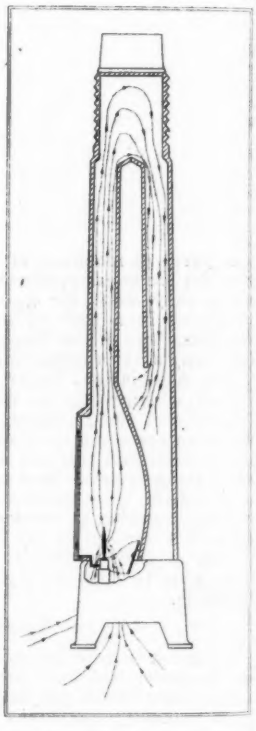
The normal scale of temperatures ranges from 650° to 1250° C., and after a little experience readings within a limit of 10° C. can be made. The colour standards are made of homogeneous crystal, highly polished and calibrated, which are incapable of even the slightest variation in colour. They are illuminated by a small paraffin lamp having an accurate regulator. No attention is necessary beyond filling the lamp, equalizing the wick as it burns, and occasional cleaning.

Modern Convection Heating.

Among new appliances which attracted interest at the B.I.F., the "Beacon" radiator (here illustrated) is claimed by the makers, the Cannon Iron Foundries, Ltd., to represent the very latest development in gas heating appliances. Here, they say, is a radiator; requiring no flue connection, which can be fitted with confidence in offices, shops, halls, corridors, &c., or even in living-rooms where no chimney has been provided, thus furnishing a competent means of meeting electrical competition. A flat-flame burner, controlled by a constant volume governor, is surmounted by a column of singularly pleasing design. The diluted products of combustion pass up the front tube and down the rear tube, escaping near the base of the latter. Condensate is entirely prevented by coating the interior surfaces of the front tube with vitreous enamel. (It will be remembered that this has always been a feature of the Cannon "Belle" radiator.) In this way a great part of the heat is subtracted from the products and emitted in the form of low-temperature radiation from the iron column, the remainder serving to heat the room by convection.

The combustion of this appliance has been the subject of very careful tests. The gases leaving the radiator contain only 1 per cent. of CO_2, which is harmless, and less than 0·001 per cent. of CO, an amount very much less than that





usually obtaining in busy city streets. The tall model burns 6 c.ft. of gas per hour per column, and the smaller model 4 c.ft. A single tall column is sufficient to maintain a comfortable temperature in a hall or room of 1200-1500 c.ft. capacity, depending on the height and ventilation of the apartment. A unique feature is the orange coloured glass window, uniformly illuminated, which gives a most cheerful appearance to the radiator when alight. Concealed in the top of the column, a boiling burner, of capacity 10 c.ft. per hour on $\frac{3}{16}$ in., can be fitted if desired, controlled by an additional tap on the right-hand side of the base. All the connections to the top-burner, although accessible for repairs or adjustment, are quite invisible from the front. The addition of the concealed boiling burner meets a real need in offices or shops, where the consumer may wish to have the means of boiling a kettle without the appearance of a gas stove.

The radiator is supplied in a pleasing bronze finish, adding considerably to the attractive appearance of this new appliance, and in one, two, or three column sizes.

Imperial Continental Gas Association

EXTRAORDINARY GENERAL MEETING

An Extraordinary General Meeting of the Imperial Continental Gas Association was held at Winchester House, Old Broad Street, London, on Tuesday, the 22nd March, Sir HENRY BIRCHENOUGH, Bart., K.C.M.G. (Chairman), presiding.

The SECRETARY (Mr. W. E. Bowers) read the notice convening the meeting, and also the two resolutions which were put before the meeting—viz.:

(1) That the capital of the Association be increased to the sum of £5,600,000 by the creation of 2,600,000 new shares of £1 each.

(2) That it is desirable to capitalize the sum of £2,800,000 representing accretions to capital available for capitalization under the powers conferred by Section 13 of the Association's Act of 1929, and that accordingly the said sum of £2,800,000 be applied in payment up in full of the unissued stock and shares of the Association, that the shares so paid up be converted into stock, and that the resulting £2,800,000 new paid up stock be issued as ordinary stock to the holders of ordinary stock of the Association on the Register on the 31st day of March, 1932, in proportion to the amounts of their existing holdings, and ranking *pari passu* therewith for the final dividend for the year ending 31st March, 1932.

The CHAIRMAN:

My Lords, Ladies and Gentlemen—

This is the first opportunity I have had of meeting the proprietors since I was appointed by the good will of my fellow Directors Chairman of your Company. I am sure that you will realize how much pleasure this mark of their confidence has given me after serving this Association for about thirty years either as an ordinary member of the Board or as Deputy-Chairman. I venture to hope, ladies and gentlemen, that I may secure an equal measure of your confidence during the period of my Chairmanship.

My satisfaction is necessarily tempered with deep regret at the loss the Company has sustained by the death of our late Chairman, Col. Le Roy-Lewis. This being an Extraordinary General Meeting, convoked for a particular purpose, does not afford me a suitable opportunity for expressing our appreciation of the great services Col. Le Roy-Lewis rendered to the Imperial Continental Gas Association by his remarkable business ability and by his entire devotion to the Company's prosperity and progress. [Hear, hear.]

I will only say this to-day: the proposals we are going to make to you, which have for their object to bring our capital into a more natural and logical relation to our assets, would have met with his entire sympathy and approval. I regret indeed that it did not fall to his lot to make the proposals, which I have to make to you to-day.

Before proceeding with the business which has brought us together to-day, there are one or two other matters of domestic interest which I will take this opportunity of mentioning, although they are not really relevant to the purpose of this Meeting.

The vacancy on the Board, due to the death of Col. Le Roy-Lewis, has been filled by the election of Mr. F. H. James, our very efficient and energetic General Manager, who is well known to you all. [Applause.] His signal services since his appointment as General Manager marked him out for election to the Board.

Owing to the increase in our responsibilities and the great amount of work which falls to be dealt with by your Board, we have deemed it advisable to add to our numbers and increase the size of the Board from seven to nine.

We have accordingly elected M. Georges Theunis, whose services to Belgium in the capacity of Prime Minister of that country, and to the Allied cause during the Great War, need no elaboration on my part. His election constitutes a precedent; so far we have never had on this Board anyone who was not of British nationality. I think you will all agree that it is somewhat anomalous that a company like the Association, with large interests in Belgium, should have no direct Belgian representation upon its Board, and that you will congratulate us upon having secured the services of such an eminent statesman and representative of his country as M. Theunis.

The second additional election which we have made is that of Sir John Chancellor. Sir John has a most distinguished record in public administration. The last appointment he held was that of High Commissioner of the Mandated Territory of Palestine, where he distinguished himself by his marked business ability, as well as by his judgment and tact. We feel sure that he will be equally successful in city life and will strengthen our Board in many ways.

I trust that the elections which we have made will commend themselves to you. [Hear, hear.]

I should like to add here, that, by a readjustment of a sum which was voted in 1888 for travelling allowances, we have been able to find the fees of these two extra members of the Board without asking for a further vote from you on that account.

Turning to the business which has brought us together to-day, the recommendations which we are making have for their object to bring our capital and the value of our assets into closer relationship. You will not unnaturally, perhaps, ask me how it is that this disparity between our capital and our assets has arisen. As to that, I must remind you that our Association has been in existence for over one hundred years, that during the greater part of that time, thanks to a succession of very able Directors and competent Managers, it has enjoyed an almost uninterrupted measure of prosperity. Further, it has been, I think I may say, an unbroken tradition of the Board of Directors not to divide profits up to the hilt. Such a policy was the essence of wisdom in the case of a public utility enterprise with a continually expanding business. It is not surprising, therefore, to find that, although from time to time changes have taken place in our capital account, the real value of the Company's assets has increased out of due proportion to the capital and to the value of its disclosed reserves. Further, I must remind you that at the end of the Great War our German stations were liquidated and those of you who were with us at the time will remember that upon the realization of these German assets a large surplus was disclosed. The cash so received was distributed among you in the form of a return of capital and bonus dividends, but part of it was retained in our business and invested in various ways.

Some of our proprietors at the time may have thought that the Board was too conservative in its distribution of the surplus of its German assets. That is not my opinion. We have been able to add greatly to the prosperity and earning power of the Association by the use we have made of the portion of the surplus we retained.

Since the War the demands for capital for the development of our electrical enterprises have been almost insatiable, and the availability of that German surplus and the additional capital, which you have subscribed from time to time, have enabled us to bring our equipment up-to-date and to develop and expand our networks over large new areas. These undertakings are now well established, and their growth affords ample justification for the step which we are placing before you to-day. If, however, any proprietor should still hold the view that we might have been more liberal in the distribution we made out of our German settlement, I must ask him to look upon our proposals to-day as representing, *inter alia*, a further and final instalment of the surplus of the German assets.

From the circular which has been in your hands for some days, you will have gathered that the Board have made a revaluation of the investments of the Association, and that revaluation has disclosed a considerable surplus over the present book value. Your Directors accordingly propose, with your concurrence, to capitalize a part of this surplus amounting to £2,800,000, and distribute it by way of a bonus issue of stock on a £ for £ principle. This would be effected by your passing the second of the resolutions to be put before you shortly.

The first resolution is a necessary preliminary to this step. The nominal capital of the Association at present is £3,000,000, and as the capital actually issued, when the bonus issue has been made, will amount to £5,600,000, the nominal capital must be raised to the latter figure.

Now I do not suggest that our proposals fully re-establish an exact proportion between the value of our assets, on the one hand, and our capital and disclosed reserves on the other. What we are doing is to capitalize part only of the reserve which existed in your business, but which was not revealed upon the face of the Balance Sheet. A great many of our investments are not quoted, and therefore their value is largely a matter of opinion. In these circumstances it is obviously desirable that our valuation should be governed by a spirit of caution. Let me make it quite clear to you that we are not taking into account the fortuitous and perhaps fleeting advantage which we have obtained through this country's departure from the Gold Standard. In making our valuation we have adhered throughout to the old exchange parities, so that in the event of sterling returning to its old parity no re-adjustment of our book values will be necessary. [Hear, hear.]

I have no desire to exaggerate to you, as proprietors, the importance of the step we are asking you to take. It is largely a matter of book-keeping, for it will be obvious to you that if we doubled our capital and halved the rate of dividend payable upon the doubled capital you would remain practically in the same position as you are to-day.

I am glad to say that the Accounts of our Associated Companies enable us to forecast that we shall be able to do somewhat better than that for you. [Hear, hear.] Although our completed accounts for the year will not be made up until after March 31st, we have every expectation of being able to recommend the payment of a final dividend of 7 p.ct., less tax, upon the doubled capital. The effect of this will be that instead of a dividend of 10 p.ct. upon the doubled capital, you will receive a distribution for the year equivalent to 10¾ p.ct., less income-tax.

There is one other point in connection with our proposals which most of us would consider an advantage. When our

stock is quoted on the new basis, the Stock Exchange quotation for each £100 of stock will obviously fall. I will not say by how much, but in any case to a more manageable figure from the point of view of investors than it stands at to-day, and this should, I think, have the effect of making the stock much more marketable.

Before I sit down, and while I have this opportunity of addressing you, I wish to repeat the warning which we gave you at our last General Meeting, I think it was, that you must be prepared to see a substantial reduction in our disclosed Reserves when our next Balance Sheet appears. This, of course, in no way arises from the proposals we are putting before you to-day. A part of these Reserves, of which I am speaking, was provided against the day when certain of our old works would be put out of action. Those works have now been shut down, and we shall have to use the Reserve for the purpose for which it was provided and write down drastically the asset value of those works in our Balance Sheet. This again is purely a matter of book-keeping. Our earning power will not in any way be affected thereby.

I have only a few words to add, in conclusion, Ladies and Gentlemen. Reminiscence is said to be vouchsafed to us as a consolation for the disability of old age. This Association, as I have already reminded you, has been in existence for over one hundred years, and in spite of the abundant activity of which it to-day gives every evidence, it surely needs no apology if from time to time it avails itself of the privilege of old age and casts a backward look over its long and eventful history. I have complete confidence that if we continue to pursue the double policy of enterprise in business and caution in finance, our future will be as prosperous as our past.

I now have the honour to propose to you the two resolutions which the Secretary has read. As I think you are acquainted with them I will not read them again, and I will ask you whether you do not think it advisable for us to vote on the two resolutions together. They hang together, and I think we might vote on them together unless any proprietor thinks otherwise. I will ask my colleague, Sir Guy Fleetwood Wilson, to second the proposal, and then we shall be very glad to hear any observations and to answer any questions which you may wish to put to us.

Sir GUY FLEETWOOD WILSON: I beg to second the motion.

The CHAIRMAN: Would any proprietor care to make any comments?

Mr. ROBERT HOVELL: As a new shareholder—although my parents have held stock in the Association for many years—I beg to offer my humble congratulations to the Board on the decision they have taken. The Association is old and its Reserves are large. I think there are advantages in capitalizing the Reserves as the Board have done, and I think it is entirely in the interests of the stockholders that these Reserves should, in a measure, be capitalized. I note what the Chairman said, that this is not a final adjustment of the Reserves, and I look forward in the years to come to perhaps a repetition of a similar proposal by the Board in not, perhaps, fully paid shares, but partly paid shares, the remainder being met by a further transfer from Reserves. I beg to congratulate the Board sincerely on their present decision, which they have arrived at after great consideration and some hesitation, and I think it will be altogether to the advantage of the stockholders.

A SHAREHOLDER: What is the actual surplus after this revaluation? Can you tell us what it is? [Laughter.]

The CHAIRMAN: I am afraid I cannot tell you that. [Laughter.] I might perhaps say we have gone as far as we can. We are a very cautious Board, and I think the stockholders have always regarded this Company, at any rate for the last fifty years, as being cautiously managed. That is why we have arrived at the happy position we are in to-day.

There were no further comments on the resolutions.

The CHAIRMAN: I now put the resolutions to the meeting.

The motion was carried unanimously.

The CHAIRMAN: This has been a very happy little meeting, and I thank you for your attendance. We have nothing more to put before you now. We shall meet again on May 25th.

Mr. P. J. BIRD: I beg to propose a hearty vote of thanks to our Chairman for so ably presiding at this meeting. In view of his most distinguished record in other realms outside this Board we can congratulate him on his patience and the clever way in which he answered a most delicate question. [Laughter.]

The vote of thanks was carried with acclamation.

The CHAIRMAN: I thank you, and could only wish that some of my other occupations were as happy as this meeting has been.

The proceedings then closed.

Yeovil's New Gas-Works Site

Board of Trade Inquiry

Objections to the sites suggested for the proposed new gas-works and gasholder on the ground that they were unsuitable and would injure the amenities of certain property in the district were offered at a Board of Trade inquiry held at Yeovil on Tuesday of last week, when the application of the Yeovil Town Council for Special Orders under the Gas Undertakings Acts was considered. The Council seeks authority to acquire 16 acres of land at Yew Tree Close as a site for new works, and two acres for the erection of a holder. Under the Orders authority is also sought to extend the present limits of supply.

The inquiry was conducted by Mr. J. F. Ronca, Director of Gas Administration to the Board of Trade. Mr. A. Myddelton Wilshere (instructed by the Town Clerk of Yeovil) appeared on behalf of the Council; Mr. Joshua Scholefield, K.C. (instructed by Messrs. J. R. Welch, Son, & Algar), represented a number of the residents objecting, and also (instructed by Mr. C. F. Saunders, of Crewkerne) Mr. Arthur Cribb, of Yew Tree House, who was also an objector. Mr. F. G. Bradford, solicitor, of Yeovil, represented Messrs. Petters, Ltd.

Mr. WILSHERE said objections had been raised by certain individual groups. They might be divided into four classes, he observed, and he went on to explain the distances of their properties from the site: There was Mr. Cribb; perhaps he might call the next the Mr. Snell group, and there was the Mr. Long group. The latter's houses seemed altogether remote from the site. Then there were miscellaneous objectors numbering several hundred, but he thought their objections were somewhat frivolous, because they were on the other side of the railway and impossible to be affected. The objections were all the same, and were, first, that the land was likely to be flooded. He thought an inspection would satisfy the Inspector that the possibility of floods in ordinary circumstances was very remote. Another objection was that the road was not suitable. The third objection was the usual one, that the amenities of the place would be destroyed. The amenities at present consisted of a considerable amount of noise from the railway, an excellent view of Messrs. Petters' works, and another excellent view of the stone works. Steps had to be taken to put up a new gasholder on the two-acre site because it was an urgent necessity. It was at first thought that the whole of the new plant would be put up on the 16-acre field, but it was not now proposed to do that immediately, but to meet the most crying needs by adding four retorts to the present works and to add a pumping or booster apparatus.

Mr. *William James Imbrie*, Manager of the works since 1921, gave evidence in support of Counsel's opening, and said a new holder with a storage capacity of a million c.ft. was necessary as soon as possible.

Mr. SCHOLEFIELD handed photographs to Mr. Imbrie taken by Mr. Waters and Mr. Snell on Jan. 10, showing the land flooded. "I put it to you," he said, "that flooding has taken place for many days in every winter in recent years."

Witness: Not many days. Replying to further questions, he said he did not think it had extended over several days.

Mr. *Edward A. Stagg*, Headmaster of Reckleford Boys' School, a member of the Mid-Wessex Rainfall Association, said that from 9 a.m. on Jan. 9 till 9 a.m. on Jan. 10 2·55 in. of rain were recorded, and from the 10th till the 11th 0·45 in.—a total of 3 in. for the period. He thought a report, which Mr. Wilshere read from the "Western Gazette," referring to floods and damage in the Yeovil district, would be correct.

Mr. *John Derryman*, owner of the land, said he had been acquainted with it for 40 years. The part which got flooded was close to the railway line. He could only remember it twice in the last three years, and the last time on Jan. 9-10. It was gone between 12 and 24 hours. He knew there was flooding once about every two or three years.

Mr. *W. Doig Gibb*, Consulting Gas Engineer, said when the Inspector visited the site he should see the number of molehills. It was a well known fact moles would not live in ground that was naturally flooded.

Mr. WILSHERE: I am afraid we cannot call the moles. [Laughter.]

Mr. SCHOLEFIELD called Mr. *Arthur Baron*, Chartered Civil Engineer, of Westminster. Replying to questions, he said there was a piece of land next to the sewage works which Mr. Imbrie said was reserved for sewage, and which was certainly in every way suitable for the extension. Answering other questions, he said nobody wanted gas-works close to them. With modern methods—and he meant vertical retorts, and not horizontal—one could eliminate noise to a considerable extent. One could not eliminate smell. They could, however, reduce it considerably. He had never been near gas-works he could not tell were there.

Mr. *William Henry Cox Waters*, of Hendford Hill, said he had lived there ten years, and had never known a single winter when flooding of the proposed works site had not taken place to a greater or less degree when there had been a fall of an inch—that was a rainfall of sufficient intensity to cause the overloading of the outfall culvert. In relation to the flooding he did not refer to the gasholder site. He would not have bought his house in the face of gas-works either being constructed or existing on the site. He went on to give reasons for saying the scheme must depress the value. The gasholder, he said, would be a definite detriment to Mr. Cribb's house. Mr. Cribb was the owner of land at the rear of houses already built on West

Coker Road. Witness had prepared for Mr. Cribb a lay-out plan for that land, which he thought would be a pretty garden city arrangement, and he should say those sites would be affected by the erection of this gasholder.

Mr. *Arthur Cribb* said the effect of the Council's proposals already had been to hold up his scheme for development. The gasholder would also diminish the value of his house.

Mr. WILSHERE: Since the purchase in 1928 you have only sold six plots that have houses on them or building, and seven other plots?—Fourteen plots.

He agreed there had never been a better time for selling, but said he had not pushed the thing.

Mr. *Edwin Snell*, of Hendford Hill, said he most strongly feared it would diminish the value of property.

Mr. WILSHERE said there was not a shred of concrete evidence that these properties had in fact depreciated since the proposals were known, and it was important to remember with one exception only the back windows of the premises overlooked the land. He asked the Inspector to say there was no question of lost amenity, and that a compensation clause should not go in, because the substantial ground for objection was possible nuisance.

The Inspector afterwards visited the present works and arranged to visit the land with the Council's Engineer and Mr. Waters.

British Gas Light Company, Ltd.

The Two Hundred and First Ordinary General Meeting of the British Gas Light Company, Ltd., was held on Wednesday, March 23, at the Chief Office of the Company, 2, The Abbey Garden, Westminster, S.W. 1—Mr. HENRY WOODALL, M.Inst.C.E., Chairman and Managing Director, presiding.

The SECRETARY (Mr. A. J. Mumford) read the notice convening the meeting, together with the report of the Auditors. The Directors' Report and the statement of accounts for the year ended December 31, 1931, were taken as read.

THE CHAIRMAN'S ADDRESS.

The CHAIRMAN said: This, as you see by the Report, is the 201st Ordinary General Meeting of the Company.

My first and sad duty is to report the death of our colleague, Mr. Abbey-Williams. He served the Company faithfully for nearly twenty years, and was a most regular attendant at our meetings, and we very much miss his cheerful presence.

Last year was not one of general prosperity, but we managed to improve our position. We are disappointed to have to report even a very slight decrease in the sale of gas—which goes into a second place of decimals. The reason we have not shown an increase is largely due to the mild weather. We have had in each of our 29 gas undertakings—you know we have in addition a water undertaking and an electricity undertaking—an increase in the number of consumers, and our total increase of consumers during the year was 3260, or just over 2½ p.ct.

In common with other gas undertakings we have been selling large quantities of apparatus and appliances for the use of gas. The total sales in 1931 exceeded £46,000, and in addition consumers buy apparatus from the stores and ironmongers. I am glad to say, however, that we are always improving and adding to our showrooms, and our consumers in ever-increasing numbers buy from us all their requirements from gas mantles upwards. This we encourage as much as possible as we can then be sure that, as far as in us lies, the purchasers are provided with the best apparatus, properly adjusted for use with the quality of the gas supplied.

The very large sales of apparatus throughout the Industry are not reflected quite as one might expect in the output, but this is to no little extent accounted for by the greater efficiency of the modern burners, cookers, fires, &c.

The expenses of distribution of gas are heavy and generally increasing, but it is found that good service and immediate attention to consumers' complaints are essential to success; the only good consumer is the contented consumer.

Taking into account the mildness of the weather and the general depression last year, we are satisfied with the result of the year's working, and for the reasons I have mentioned we can look forward to improved results when the general prosperity that we hope for returns.

The year's results show that, after meeting all charges and paying the usual dividend (7½ per cent. for the year), we are able to add £15,000 to the General Reserve Fund, just under £10,000 to the Pension and Superannuation Funds, and increase the Carry-Forward to £87,552, an addition of £1483.

At Hull we did not quite earn the full Parliamentary interest. The deficit, £2492, was drawn from the reserve fund formed for the purpose, which stood at £85,695. At Norwich, however, the profits more than met the full Parliamentary interest, and we were able to place £3838 to reserve fund. So the local reserve funds in total as well as the general reserve fund (London) have been increased. Trowbridge has more than earned its Parliamentary interest.

PUBLIC LIGHTING AT HULL.

Last year I referred to the possibility of our losing the public lighting at Hull. The Corporation applied to the Ministry of Health for authority to raise a loan for the purpose of providing electricity in place of gas for the public lamps. We opposed the application, and a local inquiry was held. During the inquiry evidence was given showing the advantages of gas for public lighting and the extravagance, at a time when economy was essential, of replacing gas by electricity. The result was that the full powers asked were not granted, and we hope to retain a reasonable portion of the public lighting. We have recently had some conference with the members of the Corporation and their officials, and I am glad to say our relationship with them is friendly and cordial. It is generally recognized in the city that we have earned the goodwill of the community and that our works at Hull are a model of efficiency.

Reference is made in the Report to the amalgamation of the Flint gas undertaking. We have owned the adjoining undertaking at Holywell since 1824. Holywell was, I believe, the first town in North Wales to be lighted by gas. A connecting main is being laid to link up the two districts, and ultimately the manufacture will be centralized. The profits of the two undertakings this year have been satisfactory, and we may expect excellent returns when the centralization is complete.

The results from subsidiary companies, now numbering 22, show a steady improvement. The actual yield on our investment in these companies shows an addition of ¼ per cent. for the year. The increase in the sale of gas by the subsidiary companies is 1·37 per cent. As I have before stated, the fact of having our works distributed throughout the country does enhance the security of the Company. It takes time, as you will realize, to raise the undertakings we acquire to our standard, but it is well worth while. With our large staff of fully competent men in all departments, and in the fact that we purchase coal, plant, &c., in large quantities, we possess great advantages over the small and sometimes isolated companies.

PROPOSED STOCK ISSUE.

I referred at the last meeting to the temporary loan from our bankers. At the end of the year the loan stood at £256,000, and has since been increased. Our bankers, as I have before told you, have always been most helpful, and in consultation with them last year we decided not to make any new issue. That decision was a wise one, and resulted in a considerable saving to the Company. The amount now owing to the bank is substantial, and, it is felt, should be reduced. Gas stocks are standing high and are regarded as a safe investment, and this is a very good time to raise capital. We have been offered terms considerably more favourable than those of last lear, and we propose very shortly to make an issue.

This Company has always adopted a progressive policy, and we are in no way departing from it. In acquiring further properties we are only carrying on the work the Company was formed over a hundred years ago to do. We have, as you know, in the past disposed of some of our important undertakings, owing to their acquisition by Local Authorities, and we must fill up the gaps. It is not easy to acquire any but comparatively small undertakings, but it is very satisfactory to note the rapid growth of some of them when capital and experience are brought into play. During the year under review some of the smaller undertakings have done extremely well and show increases, in one case of 34·8 per cent., in another 32·5 per cent., and another 25 per cent. Although the total is not great, it is pleasant and stimulating to see such returns.

The work of this office is growing, but we have a most loyal and keen staff, and additional work is welcomed. A feeling of despondency develops in the office if we have not new purchases in sight. My position as Chairman calls for increasing activity, as I like to keep in personal touch with our stations and their managers. I am extremely fortunate in having a most able and active Deputy in Mr. Palmer, who is always willing to help, as are all the members of the Board.

PENSIONS FOR OFFICERS.

In the past, as you are aware, this Company has dealt, I think I can say, generously with officials, staff, and workmen on their retirement. In 1924, to mark the centenary of the Company, a Pension Scheme for workmen was instituted, and has been greatly appreciated, but no special provision was made for officials. You will be pleased to hear that this year we have been able to start a scheme, in conjunction with an Insurance Company, for the benefit of officials, contributions to the scheme being made jointly by the Company and the officials. Our officers are now entitled to pensions, and are not dependent, as in the past, on the pleasure of the Board.

The position of the Gas Industry is thoroughly sound. We

are feeling to some extent the policy of economy which is being generally practised, sometimes perhaps unwisely. We are, however, I think, the poor man's friend, because we supply necessary heat, power, and light on the best possible terms. Both the gas undertakings and the makers of gas apparatus are doing more than ever, in the way of experiment and research, to provide gas of the most suitable quality, and also the most economical and efficient apparatus in which to use it.

Those of you who read the report of the proceedings in Parliament on the Kettering Gas Bill will have been pleased to note the feeling expressed on all sides that the Bill should go forward, and that the Second Reading was passed without a division. The purpose of the Bill is to prevent the Kettering Urban District Council from imposing conditions that only electricity should be used by tenants of the Council houses. These houses are erected at the cost of ratepayers, and the Gas Company is one of the largest. It is monstrous that landlords, whether municipal or private, should interfere in such a way with the domestic rights of citizens. The policy of the Kettering Urban District Council is not universal, and the action of the London County Council in adopting the recommendation of their Housing Committee, to the effect that the tenants of their Council houses should be given freedom to select gas or electricity, is a pleasant contrast to the partisan spirit of the Kettering authorities. The Kettering Gas Company is to be congratulated on the stand it has taken, and it has the support of the National Gas Council. It is hoped that the Bill will be passed and its justice generally recognized, and we shall no longer suffer, as many of us have done in the past, by this unfair **treatment.**

I have now much pleasure in proposing the adoption of the Report and Accounts.

The DEPUTY-CHAIRMAN (Mr. Harold G. Palmer) formally seconded, and, no questions being raised, the resolution was put to the meeting and carried unanimously.

The CHAIRMAN next moved that the payment by the Directors of the dividend at the rate of 7 per cent. per annum, less income-tax, on the cumulative preference stock of the Company, as mentioned in their Report of March 14, 1932, be confirmed.

This was seconded by the DEPUTY-CHAIRMAN and carried.

DIVIDENDS.

The CHAIRMAN next moved that the payment by the Directors of the interim dividend at the rate of 3½ per cent., less income-tax, on the ordinary stock, as mentioned in their Report of March 14, 1932, be confirmed; that a final dividend on the ordinary stock at the rate of 4 per cent., less income-tax, making 7½ per cent. for the year, less income-tax, be now declared, the same to be payable on April 1 next; and that the dividend warrants be sent by post to the last known address of each proprietor, unless instructions have been received to the contrary.

This was also seconded by the DEPUTY-CHAIRMAN and carried unanimously.

RE-ELECTION OF DIRECTORS.

The DEPUTY-CHAIRMAN said: I am now going to ask you to accept the proposal that Mr. Edward Corbet Woodall be re-elected a Director of this Company. Mr. Edward Woodall has many qualifications in his own right for this post, which, as the Chairman and the Report stated, became vacant in May last owing to the very much regretted death of Mr. Abbey-Williams. Mr. Edward Woodall is an M.A. of Oxford University and has been called to the Bar. He has had a very considerable training in the practical side of gas-works practice at the works of the Bournemouth Gas and Water Company under the able guidance of the Engineer, Mr. P. G. G. Moon. He is also a Director of the Tottenham and District Gas Company. In addition, he was blessed with having in his name the Christian name of his grandfather, the late Sir Corbet Woodall, who was the Chairman of this Company at the time when I had the honour of being made a Director; and it is this fact, coupled with my prejudice in favour of reasonable nepotism, which makes me propose this resolution with confidence of your approval. I hardly think I need extol the ability of your Chairman, whose good management of this concern has shown itself in the accounts and in his statements; but I would add that nowhere can one learn the work and business of gas company administration—which is really essential—better than under our present Chairman's leadership. So I am sure that Mr. Edward Woodall will in time reach the position of his father and his grandfather if you select him as a Director now.

Mr. A. G. GLASGOW said that he had a life-long intimate knowledge of Mr. Edward Woodall. He therefore welcomed the privilege of seconding his re-election, and congratulated the Directors in having selected him to complete the Board. Apart from his own sufficient personality, he had no doubt whatever that the benefits that their Industry owed to the intimate co-operation of Sir Corbet Woodall and his son would be repeated by the co-operation they were now anticipating between their present Chairman and his son. He had great pleasure in seconding the motion.

Mr. EDWARD WOODALL, in acknowledging his re-election, which was carried unanimously, said that he appreciated very much the way they had elected him to the Board and the kind things they had said about him. He appreciated the confidence that had been expressed in his family, and he would endeavour to follow their example.

The CHAIRMAN then moved the re-election of Mr. A. W. Brookes. There was no need for him to say anything about the re-election of Mr. Brookes, for it was over fifty years since he first commenced to help the Company. They were extraordinarily fortunate in securing him on the Board when he felt compelled to give up his heavier duties of Secretary to the Company. He was familiar with every detail of the Company and was a very useful Director.

This resolution was seconded by the DEPUTY-CHAIRMAN and carried.

Mr. BROOKES expressed his thanks for this extension of their confidence in him. He would continue to do his best, for his interest was still with the Company and always would be.

RE-ELECTION OF AUDITORS.

Mr. KENNETH R. MACKAY then proposed that Mr. E. Knowles Corrie and Mr. William Cash, Junr., be appointed Auditors of the Company, to hold office until the next Annual General Meeting, and that the total remuneration paid to them be such sum as, after deducting income-tax for the time being chargeable thereon, shall be equivalent to a net rate of £450 per annum.

Mr. GLASGOW seconded this resolution, which was carried unanimously, and Mr. WILLIAM CASH, Junr., briefly acknowledged.

VOTES OF THANKS.

Capt. W. J. LIBERTY said that it was a very great pleasure to move that the best thanks of the proprietors be given to the Chairman and Directors for their management of the business of the Company. They were continually adding to their responsibilities and labours. They had heard that they possessed no fewer than 29 gas undertakings and that the increase in consumers during the year numbered 3260, while the General Reserve Fund totalled £140,000, which showed a little of the work of the Directors. They were very glad to hear about the public lighting in Hull, for, eighteen months ago, it looked as if they were going to lose all the public lighting there. The strenuous work put in by the Chairman, backed up by Mr. H. E. Copp at Hull, had kept a good proportion of the public lighting in their hands. He thought that this was one reason why the Directors should be very warmly thanked, because the matter was of interest to the whole Kingdom.

Mr. GLASGOW seconded the vote of thanks, which was unanimously carried.

The CHAIRMAN, in acknowledging the vote of thanks, said that they appreciated what Capt. Liberty had said in regard to the public lighting, because they knew what great knowledge he had on that subject. They were fortunate in retaining a large portion of the public lighting; it was often a very difficult matter when electricity undertakings were owned by the corporations, but they were doing their best, as he was sure they would appreciate.

The Chairman said that he now had to ask them for a vote of thanks to the officers, staff, and workmen of the Company. It was recognized that they had done well in this Company for many years past. They were making progress, and that might to some extent be due to the Directors, but it was to a larger extent due to the officers, staff, and workmen. They had had unsual continuity of management. People who came into the Company lived a long time and became more interested in the Company. At the Chief Office they had Mr. Brookes for over fifty years, and during that time he had trained others who had followed him. The work here had always been done extremely well, and the old spirit of good work well done still permeated the whole place. He referred to the presentation of certificates to workmen on the completion of twenty-five years' service with the Company, together with a silver medal, and, in the case of officers, a silver cup, and he stated that up to December 31, 1931, a total of 531 medals had been presented, which, he thought, was a very good record indeed. They would be pleased to hear that they were able to do a great deal for their workmen. They had excellent recreation grounds, and a great deal of interest was taken in the men by the management. Two of their larger works had good concert rooms, which brought the men together and helped towards a happy, friendly spirit throughout the Company.

The DEPUTY-CHAIRMAN seconded the vote of thanks, which was carried unanimously.

The SECRETARY, in responding on behalf of the staff as a whole, said that the very kind way in which the vote had been proposed would be very gratifying to the officers, staff, and workmen, to whom he would convey it. He esteemed the privilege of responding on behalf of his colleagues; but he always felt on these occasions that he ought to be offering their thanks to the Board for the consideration they received at their hands and the assistance they got from them in the performance of their duties. These were strenuous days, but they in the British Gas Light Company held themselves to be very fortunate. They served a Company whose name ranked high in the Industry—a Company with splendid traditions and with a record of service to the public extending back for well over a century; but, more important still, they worked with the confidence that good leadership inspired. It would be a poor man who did not give of his best in such conditions. He referred to the Officials' Contributory Superannuation Scheme, and said that, although the officials had never had any misgivings as to what would be their fate when they had to give up work, they regarded the introduction of the scheme as a great boon, and he would like to take this opportunity of expressing publicly the thanks which he had already conveyed personally for this further proof of the great interest which the Board took in the welfare of the Company's servants. The officials and workmen, one and all, did, and would continue to do, their best in the interests of the Company, and they would be helped in knowing that their efforts met with the shareholders' approval.

This terminated the business of the meeting.

Colonial Gas Association.

A cable from Head Office in Melbourne stated that at a recent meeting of the Directors of the Colonial Gas Association interim dividends were declared for the half-year ended Dec. 31 last at the rate of 4 p.ct., less income-tax, on the preference shares, and at the rate of 3 p.ct., less income-tax, on the ordinary shares.

Exchange will be deducted from these dividends at the rate ruling on the date the dividend was declared—namely, £100 in London for £125 10s. in Melbourne. The dividends will be payable on April 4 next, and the transfer books of the Company were closed as from 5 p.m. on Thursday, March 17, and will be opened at 9 a.m. on Monday, April 4.

Having regard to the rate of exchange, shareholders may, if so desired, authorize the Association to pay their dividends in Australia to a Bank there, or to an accredited Agent. It is not possible for the Association to open any such accounts on behalf of a shareholder. This must be done by the shareholder. Where such instructions have already been given, it is not necessary to renew these, the dividends being paid in accordance with the instructions until further notice is given.

Auckland (New Zealand) Gas Company.

The Annual Meeting of the Auckland (N.Z.) Gas Company, Ltd., was presided over by the Chairman of Directors, Sir Geo. Elliot. In moving the adoption of the report and statements of account, the Chairman said: The total receipts from the sale of gas and residuals, together with the balances of the various accounts, amount to £429,052. This sum is £34,266 less than that of last year, and represents a shrinkage of 7·39 p.ct. This reduction is brought about by reduced prices for gas and coke, as well as by a lessened output. Actually, the revenue from gas has declined by £16,887, or 4·39 p.ct., an amount which is not surprising in view of the prevailing economic depression.

Revenue from the sale of residual products, coke, tar, and ammonia, is down £15,022, as compared with last year. This is caused principally by the increased efficiency of our manufacture, as we are using less coal than formerly per 1000 c.ft. of gas made, and as a consequence have less coke and tar for sale. The reduction is also caused to a minor extent by the reduction in the price of coke, which took place at the half-year, and by the fact that the output of gas has declined by the percentage already mentioned. Against the drop in revenue, however, I am glad to inform you that working expenses, excluding taxes and rates, are less by £32,373. Income-tax paid amounts to £25,001, an increast of £8852 on that of the previous year.

Higher taxation rather than reduced sales of gas is the actual cause of the reduction in dividend of 1 p.ct. now recommended. It is regrettable that there should be any lowering of a standard of dividend that has been maintained for many years, but in view of the uncertainty of the times ahead of us we are confident you will agree that this is a time when a prudent course should be steered. At our Devonport Works a setting of four-chamber ovens has been built in place of the eight intermittent vertical retorts required to be renewed. This setting has been at work for two months and is giving excellent results in an increased yield of gas per ton of coal, and improved conditions for the workers. Chamber ovens will be substituted gradually for all vertical retorts requiring to be rebuilt. During the year gas service pipes have been connected up with the premises of 514 additional consumers, bringing the total number up to 48,306, nine miles of new mains have been laid, making the total mileage 671, and 1570 cookers have been installed, making a total number of 42,301 in use.

The Metropolitan Gas Company of Melbourne.

The One-Hundred and Eighth Half-Yearly Meeting of the Metropolitan Gas Company of Melbourne was held at the Offices of the Company on Jan. 28 last—Sir JOHN GRICE (Chairman of Directors) presiding.

Moving the adoption of the report and accounts, the CHAIRMAN said: The cost of coal, including materials used in the production of carburetted water gas, was £212,985, compared with £266,654 for the December half of 1930. Tonnage of coal carbonized was 117,968 (13,765 tons less than for the December 1930 period), and 504,919 gallons of oil (a reduction of 466,727 gallons) and 8263 tons of coke were also used. Gas sales brought in £625,803. The decrease of £97,567 over the December 1930 half-year is accounted for by the reduced price charged per 1000 c.ft. and by the lower output. The quantity of gas sold for the half-year was 1,907,825,000 c.ft., compared with 2,010,348,000 c.ft. for the corresponding period of 1930—the decrease being 5·09 p.ct. For the complete year 1931 sales totalled 3,802,786,000 c.ft., against 4,032,719,000 c.ft. for the year 1930—a decrease of 229,933,000 c.ft., equal to 5·7 p.ct.

Receipts from residuals, £90,516, were lower by £12,977 compared with the December half of 1930. This is mainly caused by the decreased production of coke, due to falling off in the sales of gas and consequent reduction of quantity of coal carbonized.

The sale of " Bitural " is progressing slowly, but in the circumstances satisfactorily. The Country Roads Board purchased during the half-year 636 tons of this product, as well as 819 tons of primer coat tar for use on country roads in Victoria. Sales of sulphate of ammonia were 580 tons more than for the December half of 1930.

The report shows that the net profits for the half-year amounted to £107,255. Of that amount £15,000 has been transferred to reserve fund and £5000 to meter renewal fund. The payment of a dividend at the rate of 6s. 6d. per share, equal to a return of 7·97 p.ct. per annum on the capital contributed by shareholders, is recommended, leaving £2755 to be added to the carry-forward.

Of the dividends declared for the half-years ended Dec. 31, 1930, and June 30, 1931, the amount payable to English shareholders was £19,050 4s. Of that amount, we have been asked to transmit £5530 15s., while £7966 14s. 6d. has been placed on deposit by instruction, and the balance—£5552 14s. 6d.—is being retained awaiting further instructions.

As was to be expected, the sales of appliances by the Stove and Fittings Department were very adversely affected by the stagnant trade conditions which existed throughout 1931. During the year 82 large cooking appliances and 52 water heating appliances were disposed of to restaurants, &c., and the number of industrial appliances sold was 434. The last figure is better than that for the year 1930, and is a result, we believe, of the reductions made in the price of gas and affords proof of the efficiency of gas for many industrial purposes.

Gas Companies' Results in 1931

Barnard Castle.

The report of the Directors of the Barnard Castle Gas Company, presented at the Annual Meeting, at which Col. H. C. Watson presided, stated that the gross profit for the year's working was £558, but from this had to be deducted interest on bank loan, interest on mortgage debentures, income-tax, &c., amounting to £625, which made a loss on the year of £66. In the circumstances the Directors regretted that they were unable to recommend a dividend. A proposal by Mr. T. H. Hunter, one of the shareholders, that in consideration of there being no dividend shareholders using gas should be charged only half-price was not seconded.

Blyth.

Presiding at the Annual Meeting of the Blyth (Northumberland) Gas Company, Councillor Robert Bell said that in view of the conditions prevailing to-day it was most satisfactory to report an increase in the sale of gas. During the year 209,434,000 c.ft., or 942,453 therms, of gas had been produced—an increase of 1,880,000 c.ft. over 1930. In some quarters, the Chairman added, there was an impression that gas lighting had ceased to exist, but when he told them that during the year they sold 1455 burners with globes and mantles they would realize that gas lighting was still a live proposition. Consumers served by the Company numbered 10,747, and 1323 public lamps were supplied with gas. These figures showed an increase of 113 and 19 respectively. Income amounted to £43,235, and expenditure £38,275. The net increase on gas sold amounted to £1606. There was a slight decrease in the ordinary meter consumption, but the prepayment meter and public lighting consumption showed a steady increase. Rates and taxes had increased by £588 to £3895, which proved a great deterrent to the cheapening of the price of gas. The sum of £1225 had been transferred to reserve, which now stood at £8512. Profit and loss account, after providing for dividends, bank interest, &c., showed a credit balance of £10,859. It was decided to declare a dividend of 8 p.ct. for the year.

Horley.

The Annual General Meeting of the Horley District Gas Company was held at the Company's Offices, Station Road, Horley, when Mr. H. J. Randall (Chairman of the Directors) presided. The Chairman, moving the adoption of the report and accounts, said that the revenue account showed a balance carried to the credit of the profit and loss account of £5672. There were only three items which called for comment on the expenditure side. There was an increase of £718 in respect of repairs of works due to renewals and reconstruction of the retort benches. The balance of these costs, £1700, had been carried to a suspense account. Item two was a decrease on wages of £406, which was entirely due to the working of the reconstructed benches of through retorts, and, as the whole of the new system had not been in operation for a complete twelve months, the saving during the current year would be even greater, so they would see the expenditure had been fully justified. There was also an increased expenditure on stoves and fittings account of £954, but the increase in sales in this direction was approximately £1200 in excess of last year's figure. On the receipts side of the revenue account, the gas rental showed a very satisfactory increase of £520. In regard to residual products, coke showed an increase of £370, while receipts from tar remained practically unchanged. The sales of gas showed an increase of over 2½ million c.ft. During the year, 162 new consumers had

been added, and 395 additional appliances fixed. The profit and loss account showed an available balance of £4765, after providing for the interim dividend paid on Sept. 8 last, and providing for the fixed charges for interest, &c., and a proposition would be submitted to pay a final dividend to absorb an amount of £2187, leaving a carry forward of £2578, as against £2546 brought in. Mr. F. E. Greene then proposed: "That final dividends at the rate of 5 p.ct. per annum on the preference stock; 10 p.ct. per annum on the 'A' capital stock; and 7 p.ct. per annum on the additional 'B' capital stock (all less income-tax) be paid for the half-year ended Dec. 31, 1931."

Lichfield.

Mr. G. S. Russell presided at the Annual Meeting of the Lichfield Gas Company. A dividend of 12 p.ct. for the half-year ended Dec. 31, 1931, was declared, which, with the previous half-year's dividend, made 12 p.ct. for the year. In view of the mild winter and adverse trade the result of the year's trading was considered satisfactory.

Southgate.

The sale of gas for the year by the Southgate and District Gas Company shows an increase of 5·37 p.ct. compared with that of the preceding year. After providing for interest, income-tax, &c., and transferring £2000 to the contributory pensions fund and £1000 to the reserve fund, the balance of profit available for distribution is £20,030, from which interim dividends on account of the year ended Dec. 31, 1931, were paid on Sept. 2, 1931, at the following rates—viz.: On the preference stock, 5 p.ct. per annum; and on the consolidated (7 p.ct. maximum) stock, 7 p.ct. per annum (both less income-tax), and the Directors now recommend the declaration of final dividends for the year ended Dec. 31, 1931 (less income-tax), at the same rates. This distribution (including the interim dividends) will amount to £10,610, leaving £9420 to the credit of the profit and loss account to be carried forward to the current year. During the year £28,150 7½ p.ct. redeemable debenture stock was redeemed, £13,610 5½ p.ct. redeemable debenture stock and £14,520 5 p.ct. perpetual debenture stock having been issued in place thereof.

Tonbridge.

Mr. A. H. Neve (Chairman of the Directors) presided at the Annual Meeting of the Tonbridge Gas Company, held at the Offices, High Street, when the Directors, in their report, stated: The sales of gas show an increase over the previous year, notwithstanding the mild weather which prevailed during the last three months of 1931. The 6 p.ct. redeemable debenture stock, amounting to £13,900, was redeemed in July last, and a similar amount of 5 p.ct. redeemable debenture stock was issued in its place. The accounts for the year show that there is an available balance of £8192, out of which the Directors recommend the declaration of dividends at the following rates: 14 p.ct. per annum on "A" stock; 11 p.ct. per annum on "B," "D," and "E" stocks; 5 p.ct. per annum on "C" stock. Moving the adoption of the report and accounts, the Chairman said: The sale of gas shows an increase of £681, or in terms of gas, 3½ millions of c.ft. This represents just over 1¼ p.ct. on the preceding year. We have during the year connected about 250 new consumers and fixed 664 extra gas appliances. The meter and stove rentals therefore appear in the balance-sheet at £200 better than last year. The problem of residuals continues, but we have obtained over £220 more than last year, coke especially being a favourable item. We have discontinued the manufacture of sulphate of ammonia. The total receipts are up by about £1100.

Uxbridge.

The Directors of the Uxbridge, Maidenhead, Wycombe, and District Gas Company submitted accounts which show a profit of £42,224, which, added to the balance of £7645 brought forward from last year, and bankers' interest £124, gives a total of £49,994. Deducting therefrom £10,996 for interest, and £2000 reserved for income-tax, &c., this leaves a balance of £36,998 available for dividends. The Directors, therefore, recommend the payment of dividends (less income-tax) of £5 p.ct. per annum on the 5 p.ct. preference stock, £5 10s. p.ct. per annum on the 5½ p.ct. preference stock, and £7 p.ct. per annum on the ordinary stock, which will absorb £28,682, leaving a balance of £8315 to carry forward to next year's account. Interim dividends of £2 10s. p.ct. on the 5 p.ct., £2 15s. p.ct. on the 5½ p.ct. preference stocks, and £3 10s. p.ct. on the ordinary stock were paid on Sept. 1 last, leaving a balance of £2 10s., £2 15s., and £3 10s. respectively for the half-year. The progress of the Company's sales continues to be satisfactory, the gas sold having increased by 5·78 p.ct. for the year; 2903 additional services and 2293 slot meters have been added to the Company's system. Owing to the rapid growth of the district the Directors have erected a new gasholder at Dawley, Hayes, to cope with the increased consumption. The Company made an issue of £51,557 5 p.ct. debenture stock and £33,575 ordinary stock in May last, which was over-subscribed.

[For Market Reports, see p. 804.]

STOCK AND SHARE LIST.

Official Quotations on the London and Provincial Stock Exchanges.

[For Stock Market Report, see later pages.]

Issue	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Mar. 24. (Provincial Exchanges Mar. 18.)	Rise or Fall on Week.	Transactions. Lowest and Highest Prices During the Week.
£			% p.a.	% p.a.				
1,551,868	Stk.	Oct. 5	7½	7½	Alliance & Dublin Ord. ...	103—108	—2	104—107½
374,000	,,	Jan. 4	4	4	Do. 4 p.c. Deb. ...	70—75	+5	72½
557,655	,,	Mar. 14	7	7	Barnet Ord. 7 p.c.	118—123*	...	121½—122
300,000	1	Oct. 19	1/9½	1/4½	Bombay, Ltd.	15/—20/-	...	17/-
177,750	10	Feb. 29	9	9	Bournemouth 5 p.c. ...	14½—15½	...	...
500,050	10	,,	7	7	Do. B 7 p.c. ...	12½—13½	...	13
439,160	10	,,	6	6	Do. Pref. 6 p.c. ...	11—12	...	...
50,000	Stk.	Dec. 14	3	3	Do. 3 p.c. Deb. ...	57—62	...	...
162,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	77—82	...	...
210,000	,,	,,	5	5	Do. 5 p.c. Deb. ...	99—104	...	...
357,900	,,	Mar. 14	7½	7½	Brighton, Hove, & Worthing 6 p.c. Con. ...	113—118*	...	...
540,000	,,	,,	6½	6½	Do. 5 p.c. Con. ...	105—110*	...	107½—110
195,500	,,	,,	6	6	Do. 6 p.c. B Pref.	104—109*	...	...
1,287,500	,,	Feb. 29	5	5	Bristol 5 p.c. max.	92—94a	...	...
120,420	,,	Jan. 4	4	4	Do. 1st 4 p.c. Deb. ...	80—82a	...	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	80—82a	...	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	97—98a	...	...
855,000	,,	Oct. 5	8	7	British Ord.	110—115	...	110
100,000	,,	Jan. 4	7	7	Do. 7 p.c. Pref.	110—115	...	...
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	75—80	...	...
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	95—100	...	...
160,000	,,	Jan. 4	5	5	Cambridge 5 p.c. Deb. ...	95—100	...	...
100,000	10	Nov. 30	8	6	Cape Town, Ltd.	8½—9½	...	...
100,000	10	Oct. 30	4½	4½	Do. 4½ p.c. Pref. ...	6¾—7¼	...	...
150,000	Stk.	Jan. 4	4½	4½	Do. 4½ p.c. Deb. ...	72—77	+7	...
626,860	,,	Feb. 15	6	6	Cardiff Con. Ord.	93—96	...	...
237,860	,,	Jan. 4	2½	5	Do. 5 p.c. Red. Deb.	95—100	...	...
157,150	,,	Feb. 15	5	6½	Chester 5 p.c. Ord.	84½—89½b	...	...
98,956	1	Oct. 5	1/2/-	2/-	Colombo, Ltd. Ord.... ...	27/—32/-	...	...
24,500	1	,,	1/4½	1/4½	Do. 7 p.c. Pref.	17/—19/-	...	...
609,204	1	Oct. 19	1/3·27	1/0·90	Colonial Gas Assn. Ltd. Ord.	10/—15/-	...	...
296,053	1	,,	1/5·67	1/2·54	Do. 8 p.c. Pref.	10/—15/-	...	...
2,073,280	Stk.	Feb. 15	6	5½	Commercial Ord.	95—98	...	97½
475,000	,,	Dec. 14	3	3	Do. 3 p.c. Deb. ...	59—62	+2	60—62
807,560	,,	Feb. 15	7	7	Croydon sliding scale ...	107—110	...	108—109½
469,590	,,	,,	5	5	Do. max. div.	82—87	...	82½—86
500,000	,,	Jan. 4	5	5	Do. 5 p.c. Deb.	99—102	...	...
542,270	,,	Feb. 29	7	10	Derby Con.	117—122c	...	...
55,000	,,	Jan. 4	4	4	Do. Deb.	65—70c	...	...
209,000	,,	Mar. 14	5	5	East Hull Ord. 5 p.c. ...	71—76*	...	...
179,500	,,	Feb. 29	5⅔	5⅔	East Surrey Ord. 5 p.c.	90—95	...	...
155,019	,,	Jan. 4	5	5	Do. 5 p.c. Deb. ...	96—101	...	...
1,002,180	,,	Mar. 14	14	16⅔	European, Ltd.	102—112*	...	103½—105½
19,405,992	,,	Feb. 15	5⅔	5⅔	Gas Light & Coke 4 p.c. Ord.	19/9—20/9f	...	20/—20/6
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	62—65	+2	62½—64½
4,477,106	,,	,,	4	4	Do. 4 p.c. Con. Pref. ...	79—83	..	80½—82½
6,102,497	,,	Dec. 14	3	3	Do. 3 p.c. Con. Deb. ...	62—66	+1½	62½—63½
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	100—103	...	...
2,500,000	,,	,,	4½	4½	Do. 4½ p.c. Red. Deb. ...	92—95	+1	93—94⅔
162,280	,,	Feb. 29	10	10	Harrogate Cons. 10 p.c. max.	157—162	...	...
82,500	,,	Mar. 14	7	7	Hastings & St. L. 5 p.c. Conv.	93—98*	...	...
258,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	80—85*	...	...
70,000	10	9 Oct. '30	‖	10	Hongkong & China, Ltd. ...	11—12	...	...
213,200	Stk.	Feb. 29	6	6	Hornsey Con. 3½ p.c. ...	87—90	...	...
2,800,000	,,	Oct. 30	25	15	Imperial Continental Cap.	360—380	...	370—374
223,130	,,	Feb. 1	3½	3½	Do. 3½ p.c. Red. Deb.	68—73	...	...
235,242	,,	Mar. 14	8½	8½	Lea Bridge 5 p.c. Ord. ...	126—129*	...	...
2,145,907	,,	Feb. 29	6	6	Liverpool 5 p.c. Ord. ...	100—101b	+1	...
245,500	,,	—	—	5	Do. 5 p.c. Red. Pref. ...	94—99b	...	...
306,083	,,	Jan. 15	4	4	Do. 4 p.c. Deb. ...	78—80b	...	...
165,736	,,	Feb. 15	8	10	Maidstone 5 p.c. Cap. ...	124—129	...	...
56,176	,,	Jan. 4	3	3	Do. 3 p.c. Deb. ...	55—60	...	...
75,000	5	Nov. 30	110	110	Malta & Mediterranean ...	6¾—7	...	...
392,000	—	Oct. 1	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	78—83	...	...
171,978	Stk.	Feb. 29	5	5	M. S. D. Utility "C" Cons.	76—81	...	...
718,657	,,	,,	4	4	Do. 4 p.c. Cons. Pref.	67—72	...	...
112,126	,,	g	4	4	Do. 4 p.c. Deb. ...	77—82	+7	...
148,955	,,	g	5	5	Do. 5 p.c. Deb. ...	97—102	+2	...
675,000	,,	May 21	16	16	Montevideo, Ltd.	70—80	...	...
2,061,315	,,	Feb. 29	5	5⅔	Newcastle & Gateshead Con.	17/—18/6f	...	...
682,856	,,	,,	4	4	Do. 4 p.c. Pref. ...	71—73d	...	...
691,705	,,	Jan. 4	3½	3½	Do. 3½ p.c. Deb. ...	67—68d	...	...
277,285	,,	Oct. 30	5	5	Do. 5 p.c. Red. Deb.	96—98d	...	...
199,940	,,	Mar. 14	7½	7½	North Middlesex 6 p.c. Con.	106—111*	...	...
396,160	,,	Feb. 15	5	5	Northampton 5 p.c. max. ...	72—77	...	...
300,000	,,	Nov. 30	7	9	Oriental, Ltd.	88—98	...	...
60,000	5	13 May, '15	—	—	Ottoman	0—¼	...	...
205,162	Stk.	Jan. 4	8	8	Plym'th & Stonehouse 5 p.c.	118—123	...	...
504,416	,,	Feb. 15	8	8	Portsm'th Con. Stk. 4 p.c. Std.	122—127	...	...
241,446	,,	,,	5	5	Do. 5 p.c. max. ...	78—83	...	...
686,312	,,	Jan. 18	4	4	Primitiva 4 p.c. Rd. Db. 1911	77—82	...	...
389,813	,,	Jan. 4	4	4	Do. 4 p.c. Cons. Deb.	77—82	...	...
150,000	10	Sept. 21	6	6	San Paulo 6 p.c. Pref. ...	7¼—7¾	...	...
1,736,968	Stk.	Sept. 7	6½	6	Sheffield Cons.	103—105e	...	...
95,000	,,	Jan. 18	4	4	Do. 4 p.c. Deb.	79—81e	...	...
133,201	,,	Feb. 29	8½	5	Shrewsbury 5 p.c. Ord. ...	88—93	...	...
90,000	10	June 11	15	15	South African	3—5	...	...
6,709,895	Stk.	Feb. 15	5	7	South Met. Ord.	101—104	...	102½—104
1,135,812	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	112—117	...	...
1,895,445	,,	Jan. 4	3	3	Do. 3 p.c. Deb. ...	60—63	+1	61
1,000,000	,,	Jan. 18	4	5	Do. 5 p.c. Red. Deb.	99—103	...	101½—102½
91,500	,,	Aug. 10	8½	8½	South Shields Con.	125—127d	...	...
1,543,795	,,	Feb. 15	6½	6	South Suburban Ord. 5 p.c.	102—107	...	104—105
300,000	,,	,,	5	5	Do. 5 p.c. Pref.	95—100	...	...
668,837	,,	Jan. 4	5	5	Do. 5 p.c. Deb.	98—103	+1	100½
647,740	,,	Feb. 29	5	5	Southampt'n Ord. 5 p.c. max.	74—79	...	...
121,275	,,	,,	4	4	Do. 4 p.c. Deb.	75—80	...	...
250,000	,,	Aug. 24	7	7	Swansea 7 p.c. Red. Pref. ...	96—99	...	...
200,000	,,	Jan. 4	6½	6½	Do. 6½ p.c. Red. Deb.	98—101	...	...
1,076,490	,,	Feb. 29	6½	6½	Tottenham and District Ord.	104—108	...	165½—107
300,000	,,	,,	5½	5½	Do. 5½ p.c. Pref. ...	93—98	...	...
199,005	,,	Dec. 14	4	4	Do. 4 p.c. Deb. ...	77—82	+3	81
85,701	,,	Sept. 21	6	6	Tuscan, Ltd., 6 p.c. Red. Db.	72—77	...	...
346,069	,,	Feb. 29	7	7	Uxbridge, Maidenhead, & Wycombe 5 p.c.	100—105	...	...
88,330	,,	,,	5	5	Do. 5 p.c. Pref. ...	87—92	...	...
1,322,220	,,	Feb. 29	7	7	Wandsworth and District: Consolidated	114—119	+2	116—117
971,373	,,	,,	5	5	Do. 5 p.c. Pref.	97—102	...	100—101
1,167,964	,,	Jan. 4	5	5	Do. 5 p.c. Deb.	100—103	+1	100—102½

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *f.*—The quotation is per £1 of stock. *g* The interest due 1/1/32 was paid on that date. * Ex. div. † Paid free of income-tax. ‡ For year. § Div. =10 p.c.t. p.a. less tax and less tax on interim dividend.

STOCK ISSUES.

THE EAST SURREY GAS COMPANY.

SALE OF IRREDEEMABLE 5½ PER CENT. PREFERENCE "A" STOCK.

NOTICE IS HEREBY GIVEN that it is the intention of the said Company to SELL by TENDER

£20,000

IRREDEEMABLE 5½ PER CENT. PREFERENCE "A" STOCK of the Company, at the Minimum Price of par.

The last day for the reception of Tenders will be Tuesday, the 12th of April, 1932, at 11 o'clock a.m.

Forms of Tender, with Particulars of Sale and Conditions of Tender attached, can be had upon application at the CHIEF OFFICES of the COMPANY, or at the BRANCH OFFICES: 66, HIGH STREET, REIGATE; 91, HIGH STREET, DORKING; HIGH STREET, WALTON-ON-THE-HILL; LAGHAM ROAD, SOUTH GODSTONE; and STATION ROAD, LINGFIELD; also from Messrs. SEYMOUR, PIERCE, & Co., 5, LOTHBURY, E.C. 2.

By order of the Board,
HORACE LONG,
Secretary.

Chief Offices,
Brighton Road,
Redhill, Surrey,
March 12, 1932.

By Order of the Directors.

TUNBRIDGE WELLS GAS COMPANY.

Messrs. A. & W. RICHARDS

are Instructed to OFFER FOR SALE BY TENDER

£30,000

5½ PER CENT. PERPETUAL DEBENTURE STOCK.

Minimum Price of Issue, £106 per £100.

Yielding at that Price, £5 3s. 9d. per cent.

Prospectus and Form of Tender (which latter must be sent in by 11 o'clock on Thursday, the 7th of April) may be obtained of A. & W. RICHARDS, 37, WALBROOK, E.C. 4.

By Order of the Directors.

SLOUGH GAS AND COKE COMPANY.

Messrs. A. & W. RICHARDS

are Instructed to OFFER FOR SALE BY TENDER

£12,000

FIVE PER CENT. PERPETUAL DEBENTURE STOCK.

Minimum Price of Issue, £95 per £100.

Yielding at that Price, £5 5s. 3d. per cent. Also

£18,750

ORDINARY STOCK,

ranking equally with existing similar Stock, which for the last eight years has received 7 per cent. per Annum.

Minimum Price of Issue, Par.

Prospectus and Forms of Tender (which latter must be sent in by 11 o'clock on Thursday, the 14th of April) may be obtained of A. & W. RICHARDS, 37, WALBROOK, E.C. 4.

GAS MARKETS & MANUFACTURES

Stock Market Report.

[For Stock and Share List, see earlier page.]

Although there was the usual slackening off in business prior to the holiday last week, a general tone of cheerfulness was maintained up to the close on Thursday, and markets were exceptionally steady. Gilt-edged and other high-class securities continued the strongest section, and if the Bank rate is reduced again this week the prices of these stocks will still further improve. Scrips of the latest new issues were in good demand, and in nearly every case now stand at substantial premiums.

Business in Gas stocks and shares was confined for the most part to the larger issues; there being little stock available of the smaller undertakings. Prices remained firm. Although there were few changes either way in the quotations of ordinary issues, debenture stocks continued to improve, and several large increases were recorded, notably Cape Town at 4½ p.ct. and Mid Southern District 4 p.ct., both of which gained 7 points. Alliance and Dublin 4 p.ct. rose 3 points, and Tottenham 4 p.ct. 3 points. Wandsworth consolidated ordinary gained 2 to 116½; and this Company's 5 p.ct. debenture improved 1 to 101½. It has been announced that £150,000 of this latter stock is being placed on the stock market at the price of 102½, at which figure business was recorded on Thursday last. The political crisis in Ireland caused a slight setback in Alliance and Dublin ordinary, and the price fell 2 points to 105½.

The Directors of the Bombay Gas Company have recommended a final dividend on the £1 ordinary shares of 4½ p.ct., making 8 p.ct. for the year 1931, the same as for 1930.

A further new issue, details of which appeared last week, was that of the Watford and St. Albans Gas Company. The Company is selling by tender £100,000 5½ p.ct. preference stock at a minimum price of £97 p.ct., yielding at this price £5 13s. 5d. p.ct. The accounts for last year show that the dividend on the preference capital (including the new issue) is covered nearly three times. The Company's output of gas has nearly doubled during the last eleven years, and the proceeds of the present issue will be utilized for carrying out new work in order to cope with further increases in the Company's business. Tenders must reach the Company's offices not later than Saturday, April 2.

An addition to the Stock and Share List this week is that of the 5 p.ct. perpetual preference stock of the South Suburban Gas Company. This stock was sold by tender in November, 1930, and realized an average price of £95 10s. 5d. p.ct. The present official quotation on the London Stock Exchange is 95-100.

Current Sales of Gas Products.

The London Market for Tar Products.

LONDON, *March* 29.

There is no change in the values of tar products, which are as follows:

Pitch is firm at about 95s. per ton f.o.b.

Creosote, for export, varies from 3¾d. to 5d. per gallon, according to specification.

Refined tar is 4d. to 4¼d. per gallon in bulk at makers' works.

Pure toluole is about 2s. 8d. to 2s. 9d. per gallon at makers' works; pure benzole, 1s. 8d. to 1s. 9d. per gallon; 95/160 solvent naphtha, about 1s. 5d. per gallon; and pyridine bases, about 3s. 9d. to 4s. per gallon.

Tar and Tar Products in the Provinces.

March 29.

The average prices of gas-works products during the week were: Gas-works tar, 42s. to 47s. Pitch—East Coast, 85s. to 90s. f.o.b. West Coast—Manchester, Liverpool, Clyde, 85s. to 90s. f.o.b.* Toluole, naked, North, 1s. 10½d. to 1s. 11d. Coal-tar crude naphtha, in bulk, North, 5d. to 5¼d. Solvent naphtha, naked, North, 1s. 3d. to 1s. 3½d. Heavy naphtha, North, 11d. to 11½d. Creosote, *ex* works, in bulk, North, liquid and salty, 3½d. to 3¾d.; low gravity, 1¼d.; Scotland, 3½d. to 3¾d. Heavy oils, in bulk, North, 5d. to 5¼d. Carbolic acid, 60's, 1s. 7½d. to 1s. 8d. Naphthalene, £9 to £10. Salts, 55s. to 57s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *March* 25.

Refined tar is attracting attention, and quotations are firm. Other products show little or no alteration during the week.

Crude gas-works tar.—Actual value is steady at 52s. 6d. to 57s. 6d. per ton *ex* works.

Pitch.—Export value is nominal at 82s. 6d. to 87s. 6d. per ton f.o.b Glasgow, while home trade commands 82s. 6d. to 85s. per ton *ex* works.

Refined tar to Ministry of Transport Specification.—Large quantities are now being called for, and value is firm at 4¾d. to 4⅞d. per gallon f.o.r. naked.

Creosote oil.—A fair volume of business is being transacted. B.E.S.A. Specification is 3d. to 3¼d. per gallon; low gravity 3⅞d. to 4d. per gallon; and neutral oil, 3⅝d. to 3¾d. per gallon—all *ex* works in bulk.

Cresylic acid.—Orders remain scarce. Pale, 97/99 p.ct., is 1s. 1½d. to 1s. 2½d. per gallon; dark, 97/99 p.ct., 1s. 0½d. to 1s. 1½d. per gallon; and pale, 99/100 p.ct., 1s. 3½d. to 1s. 4d. per gallon—all f.o.r. in buyers' packages.

Crude naphtha.—Value is unchanged at 4½d. to 5d. per gallon, according to quality and district.

Solvent naphtha.—Conditions are dull. 90/160 grade is 1s. 3d. to 1s. 4d. per gallon, and 90/190 grade 1s. to 1s. 1d. per gallon.

Motor benzole is quiet at 1s. 3d. to 1s. 4d. per gallon f.o.r. in bulk quantities.

Pyridines.—90/160 grade is 3s. to 3s. 3d. per gallon, and 90/140 3s. 3d. to 3s. 6d. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s.	d.		s.	d.	
Crude benzole	0	7	to	0	7½	per gallon at works
Motor "	1	2	"	1	3	" " "
Pure "	1	6	"	1	7	" " "

Trade Notes.

Benzole Recovery Plant.

The Dewsbury Corporation, on the recommendation of their Gas Engineer, Mr. H. L. Bateman, have decided to install a benzole recovery plant at their gas-works.

Ernest Ingram Hill, Ltd.

We have received from this advertising firm (29, Ludgate Hill, London, E.C. 4) a leaflet relating to their work. The firm will be glad to send a copy to any of our readers who may be interested.

John Harper & Co., Ltd.

This firm have published a comprehensive and well-illustrated catalogue of the household hardware and builders' and general hardware goods which they manufacture. Gas fires, hotplates, irons, poker-burners, and radiators are featured prominently in the list.

Combination Lifting and Elevating Device.

We have received from Mr. W. Thomas, Gas Engineer, Alamos, Sonora, Mexico, a description of a combination lifting and elevating device which he has invented. He claims that Thomas "Combination" devices have a wider range of operations than both the standard lifting devices, such as winches, chainblocks, &c., and the standard elevating devices, such as hydraulic jacks and screwjacks. They embody the advantages of both these types and eliminate their disadvantages. In fact, they are, as their name implies, a combination of these two types into one. They push, and they pull. They can be used for light duty and for heavy duty.

New Capital Issues.

East Surrey Gas Company.—The Directors are offering for sale by tender £20,000 irredeemable 5½ p.ct. preference "A" stock at a minimum price of issue of par. Tenders for the stock, which must be for amounts of £5 or upwards in multiples of £1, must be received at the Head Office of the Company, Brighton Road, Redhill, not later than 11 a.m. on Tuesday, April 12.

Tunbridge Wells.—As will be seen from our advertisement columns, Messrs. A. & W. Richards, of 37, Walbrook, E.C. 4, are offering for sale by tender, on behalf of the Directors of the Tunbridge Wells Gas Company, £30,000 5½ p.ct. perpetual debenture stock, at a minimum price of issue of £106 per £100 of stock, yielding at that price £5 3s. 9d. p.ct. Tenders must be received not later than 11 a.m. on Thursday, April 7.